Introduction

Dear users:

Thank you for purchasing UNI-T product. To operate the instrument correctly, please read this Operating Manual carefully and especially its “Safety Notice” before use.

Afer reading it, you are suggested to keep the manual properly. Please keep it with the instrument together or place it in an accessible location for future use.

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- UNI-T is a registered trademark for Uni-Trend Technology（China） Limited.

Warranty period is 3 years since original purchaser purchases the product from UNI-T or authorized distributor if product is sold or transferred to the third party within 3 years after original purchaser purchases it. Probe, other fittings and fuses are excluded in this warranty. UNI-T can decide to maintain products with defects independently without paying the expenses of parts and labor or replace them by equivalent products if there is any defect at applicable warranty period.（UNI-T）determines to replace products with any defect. Warranty parts, modules and replaced products of UNI-T may be new or with performance of new products after maintenance. All replaced parts, modules and products may become UNI-T properties.

“Users” mentioned below refer to rights persons or entities regulated by warranty according to statement. “Users” must report defects to UNI-T within appropriate warranty period with service fulfillment properly to gain service committed by warranty. Users shall pack products with defects and submit them to maintenance center designated by UNI-T. In the meanwhile, they shall pay for freight fee in advance and provide copied procurement certificate of original purchaser. UNI-T shall pay for product return expense to users if transporting product to location within state of UNI-T maintenance center. Users also shall pay for all freight fees, tariffs, taxes and other expenses if returning products to any other location.

The warranty is not applicable to any defect, trouble or damage caused by sudden accidents, normal abrasion of machine parts, improper usage, maintenance or deficiency out of scope of product regulations. UNI-T shall not be liable for providing the following services according to warranty regulations:

a) To maintain products which are damaged due to product installation, repair or maintenance by not UNI-T service representatives;
b) To maintain damage caused by improper usage or connection of incompatible equipment;
c) To maintain damage or trouble caused by using power not provided by UNI-T;
To maintain products which have been altered or integrated with other products (if such alternation or integration will increase product maintenance period or difficulty);
he warranty is signed by UNI-T by aiming to the project so as to substitute any other expressed or implicit warranty. UNI-T and distributor refuses any implicit warranty for marketability or suitability with special purpose. UNI-T shall maintain or replace products with defect to users as the unique and all remedial measures for warranty violation. UNI-T and distributor shall not responsible for such damages regardless of possible indirect, special, occidental or inevitable damage with/without prior notice.

General Safety Overview

The instrument is designed and manufactured strictly according to “Safety Requirements of Electronic Measuring Instruments” (GB4793) and IEC61010-0131:2008 Safety Standard . It conforms to “Insulation Overvoltage Standard” (CAT Ⅱ ò) and Safety Standard with Pollution Level Ⅱ òYou are expected to know the following safety precaution measures to avoid personal injury or product damage or any other product connected to it. Please use the product according to the regulations so as to avoid the possible damage.

Only personnel with professional training can execute maintenance procedure to avoid fire or personal injury. Appropriate power wires should be used and special power wires must be approved by the state.

Correct plug-in/out: Please do not plug in/out when connecting probe or testing conduits to voltage source.

Reliable grounding of products: The product is grounded by ground conductor of power supply. Ground conductor must be connected to earth to avoid electric shock. Please guarantee correct grounding before connecting input/output terminal of the product.

Correct connection of oscillograph probe: Earth wire of probe is the same to earth potential. Please do not connect earth wire to high voltage.

Review of rated values of all terminals: Please refer to all rated values and marks on the product surface to avoid fire or excessive current shock. Please refer to product manual before connecting products so as to know details of rated values.Do not open cover plate of machine box: It is not allowed to start or operate the product when opening external cover or panel.

Usage of appropriate fuse: It is only allowed to use fuse type and rated indicator designated by the product.

To avoid exposed circuits: It is not allowed to touch exposed connector or element after power supply.

Operation is not allowed if there is any doubt for product trouble: Please consult qualified maintenance personnel to inspect the product if there is any trouble doubt.

It has to maintain appropriate ventilation. It is not allowed to operate in wet locations. It is not allowed to operate in combustible and explosive environment. It has to keep product surface clean and dry.

Safety Terms and Symbols

Terms in the manual: The following terms may be seen in the manual:

> ⚠ ***Warning: Warning statement means the conditions and behaviors that may endanger lives.***

> ⚠ ***Note: Notice statement means the conditions and behaviors that may cause other property damage***

Terms for products: The following terms may be

Danger: It refers to direct injury near the mark.

Warning: It refers to potential injury near the mark.

Note: It refers to potential danger for the product and other properties.

Product symbol: Following symbols may be shown on the product surface.

High voltage

Caution!
Refer to manual

Protective ground terminal

Ground terminal for chassis

Ground terminal for testing

Preface

The manual is about operation information of OPERATING MANUAL FOR UTD2000/3000 digital storage oscillograph. The manual includes the following chapters

Chapter 1: User Guideline: It is to introduce functions of digital storage oscillograph easily and provide installation guidelines.

Chapter 2: Instrument Setup:Operation methods of OPERATING MANUAL FOR UTD2000/3000 digital storage oscillograph.

Chapter 3: Application example: Examples to solve various measurement problems

Chapter 4: System Prompt and Troubleshooting

Chapter 5: Service and Support

Chapter 6: Appendix: Appendix A: Technical Indicators

Appendix B: Fittings of OPERATING MANUAL FOR UTD2000/3000 series digital storage oscillograph

Appendix C: Maintenance and Cleaning Maintenance

Appendix D: Contrast form of Chinese and English panels

The manual includes 3 series of digital storage oscillograph as follows. Detailed models are shown in the following form:

Series		Model	Band width	Real-time
UTD2000/3000	UTD2000C/3000C	UTD2025C/UTD3025C	25MHz	250MS/s
		UTD2042C/UTD3042C	40MHz	500MS/s
		UTD2062C/UTD3062C	60MHz	500MS/s
		UTD2082C/UTD3082C	80MHz	500MS/s
		UTD2102C/UTD3102C	100MHz	500MS/s
		UTD2152C/UTD3152C	150MHz	500MS/s
		UTD2202C/UTD3202C	200MHz	500MS/s
	UTD2000E/3000E	UTD2042CE/UTD3042CE	40MHz	1GS/s
		UTD2062CE/UTD3062CE	60MHz	1GS/s
		UTD2082CE/UTD3082CE	80MHz	1GS/s
		UTD2102CE/UTD3102CE	100MHz	1GS/s
		UTD2152CE/UTD3152CE	150MHz	1GS/s
		UTD2202CE/UTD3202CE	200MHz	1GS/s
	UTD2000L	UTD2025CL	25MHz	250MS/s
		UTD2052CL	50MHz	500MS/s
		UTD2052CEL	50MHz	1GS/s
		UTD2102CEL	100MHz	1GS/s

UTD2000/3000 series digital storage oscillograph provides simple front panel with clear functions to users for all basic operations. Scale and position of various channels can provide intuitional operation to meet usage habits of traditional instruments. Users can use it skillfully without learning and being familiar with operation for a long time. Users can also press AUTO key directly to accelerate adjustment and facilitate measurement. Appropriate waveform and gear setup can be shown on the instrument panel.

UTD2000/3000 series digital storage oscillograph also has high-performance indicators and powerful functions to fulfill measurement tasks quickly besides easy usage. Quicker signals can be observed by UTD2000/3000 series digital storage oscillograph by real-time sampling of 500MS/s (or 1GS/s) and equivalent sampling of 25GS/s (or 50GS/s). It can capture and analyze waveform easily by powerful trigger and analysis capacity. Users can also observe and analyze signal problems quickly and clearly by clear LCD display and mathematical calculation function. We can see that such series of digital storage oscillograph can meet your measurement requirements by following performance characteristics:

- Double analog channels
- High-resolution colorful LCD display system with resolution of 320×240（or 800×480）
- To support plug and play USB storage instrument to communicate with computer
- Automatic waveform and status setup
- Waveform, setup, bitmap storage, waveform and setup reoccurrence

- Elaborate view window extension function for delicate analysis of waveform details and profile
- Automatic measurement of 28 kinds of waveform parameters
- Automatic cursor tracing and measurement function
- Unique waveform recording and playback functions
- Embedded FFT
- Multiple mathematical calculation functions (including +, -, ×, ÷) for waveform
- Edge, video, pulse width and ALT TRIG functions
- Multi-language menu display
- Help information display in Chinese and English

Fittings of UTD2000/3000 series digital storage oscillograph：

- 2 probes of 1.2m, 1:1/10:1; please refer to manual of probe Fittings of probe details so as to meet EN61010-031 standard.
- 1 power wire to meet national standards;
- 1 “Operating Manual”;
- 1 “Product Warranty”

USB connecting wire: UT-D06 or UT-D05

Communication control software for UTD2000/3000 series oscillograph

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Chapter 1: User Guideline

UTD2000/3000 series digital storage oscillograph is a small and handy desktop product. Basic test can be done by providing convenient front panel to facilitate operation for users.

UTD2000/3000 series are to provide simple front panel with clear functions to users for basic operation. Panel also includes knob and function key. Knob functions are similar to those of other digital storage oscillograph.

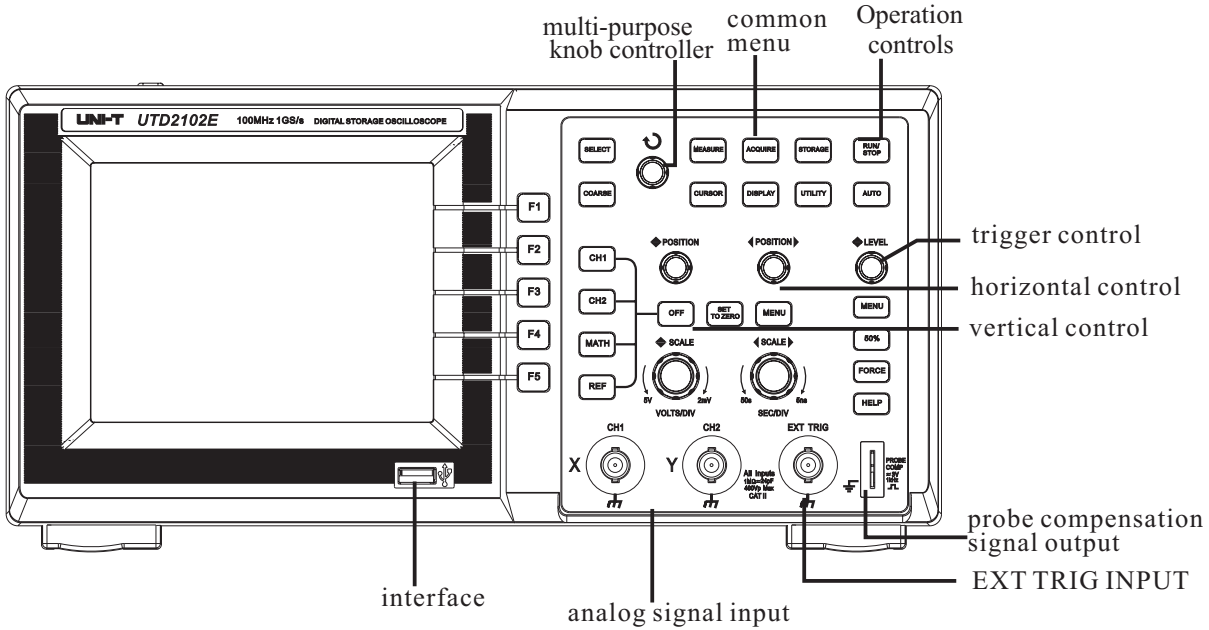
The chapter is to show execution of following steps：

△ General inspection
△ Function inspection
△ Probe compensation
△ Automatic setup of waveform display
△ Elementary understanding of vertical system
△ Elementary understanding of horizontal system
△ Elementary understanding of trigger system

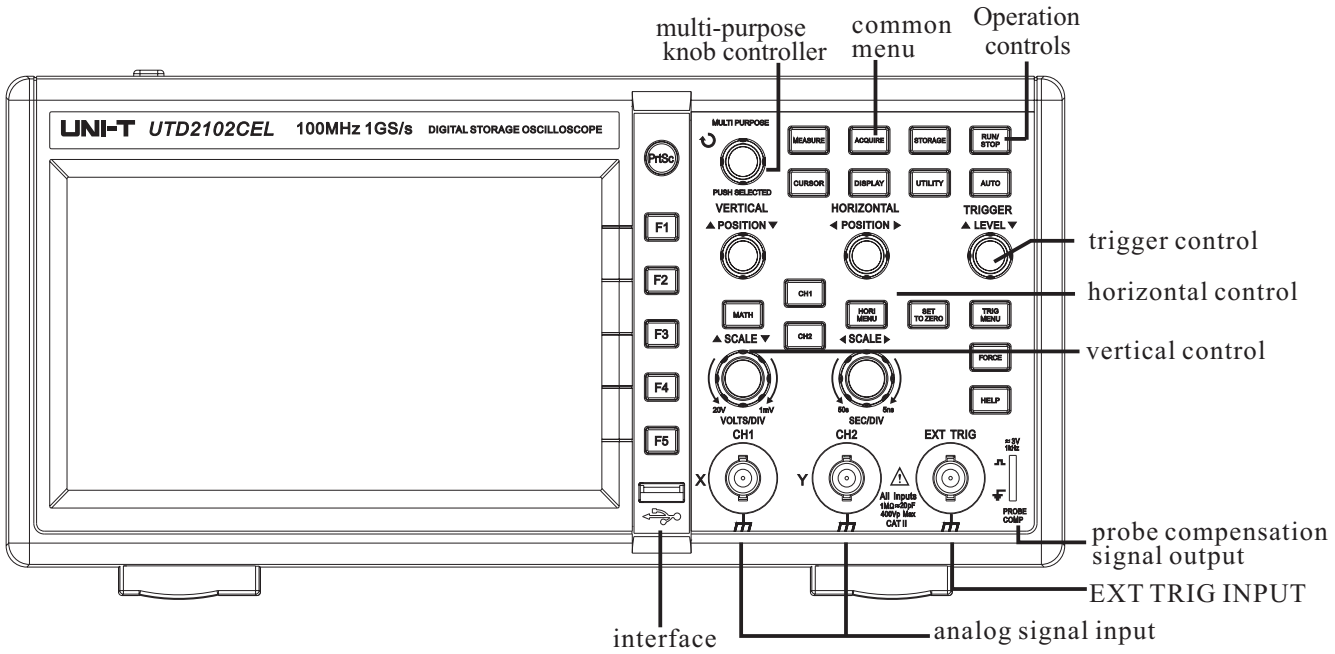
General inspection

Please know front operation panel firstly after getting UTD2000/3000 series digital storage oscillograph. The chapter is to introduce operation and functions of front panel for UTD2000/3000products so as to be familiar with usage within the shortest period.

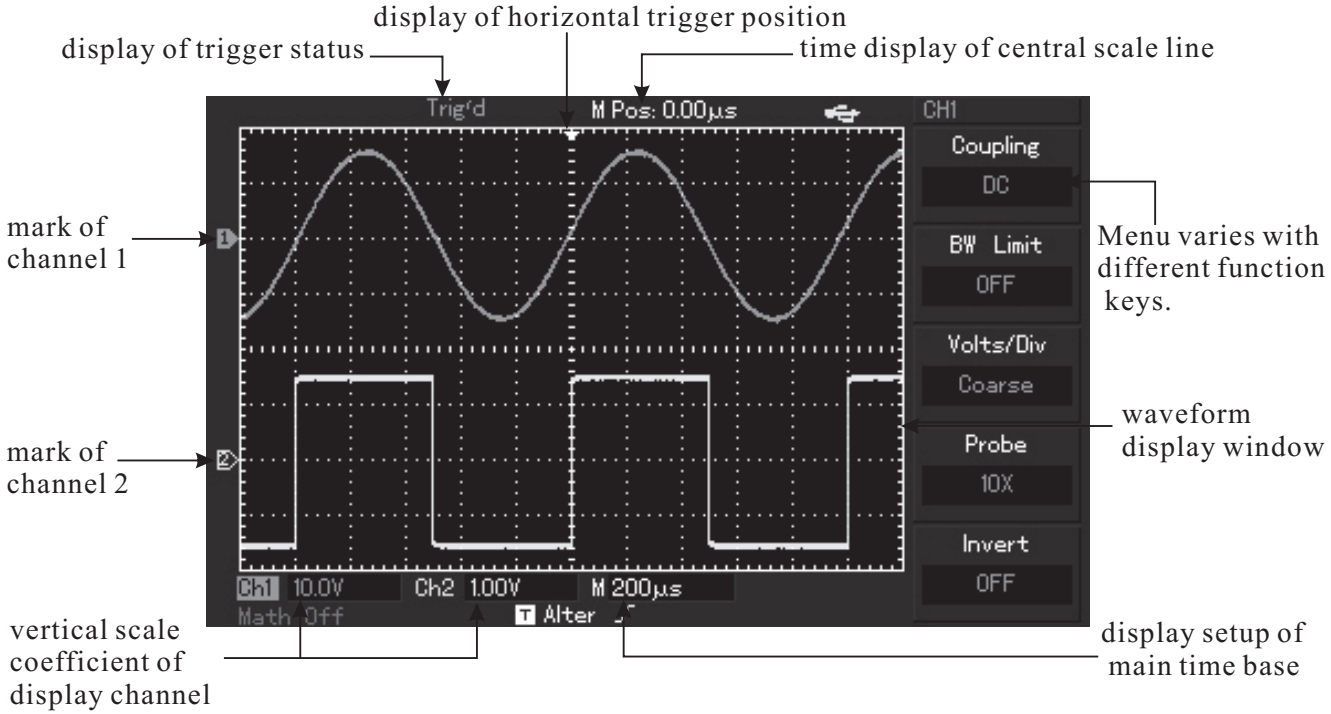
5 keys in a row in the right side of display panel are menu operation keys. (They are defined as F1 to F5 keys from top to bottom.) You can also set different options for current menu by them. Other keys are function keys. You can enter into different function menus or gain specific function application directly by them.



5．7－inch front panel of UNI-T



7-inch front panel of UNI-T



Interface display diagram of digital storage oscillograph (i.e. UTD2000L series)

General inspection

It is suggested to inspect the instrument by following steps when getting a new UTD2000/3000 series digital storage oscillograph.

1. To check if there is damage due to transportation or not.

Please replace carton or foaming plastic protection cushion with severe damage instantly.

2. Please inspect fitting details and shown it in "Fittings of UTD2000/3000 series digital Storage Oscillograph" shown in the manual. You can check if there are deficient fittings or not by referring to it. Please contact UNI-T distributor or local agent if there are deficient or damaged fittings.

3. Please inspect the entire machine and contact UNI-T distributor or local agent for damaged appearance, abnormal operation or failing to pass performance test.

Please pay attention to packages and report to transportation department and UNI-T distributor if machine damage is caused by transportation.

UNI-T will arrange maintenance or replacement.

Function inspection

Please carry out once fast function inspection to check if the machine operates normally or not.

Please operate according to following steps:

1. Connect the power supply

You can supply power to the machine and voltage is AC 100V to AC 240V. Frequency is 45Hz to 440Hz. It has to press [UTILITY] menu and [F1] for self-correction after power supply 30 minutes after operation of hot machine so that digital storage oscillograph operates under the best status. As shown in Figure 1－4, please enter into next page and press [F1] to call out ex-factory setup.

Figure 1-4

Warning: Please confirm safety grounding of digital storage oscillograph to avoid dangers.

2. Signal access of digital storage oscillograph is double-channel input for UTD2000/3000 series digital storage oscillograph. There is also 1 EXT TRIG INPUT channel. Please connect signals according to following steps:

① (As shown in Figure 1-5), connect probe of digital storage oscillograph to CH1 input terminal and set attenuation ratio switch on probe to 10×Á

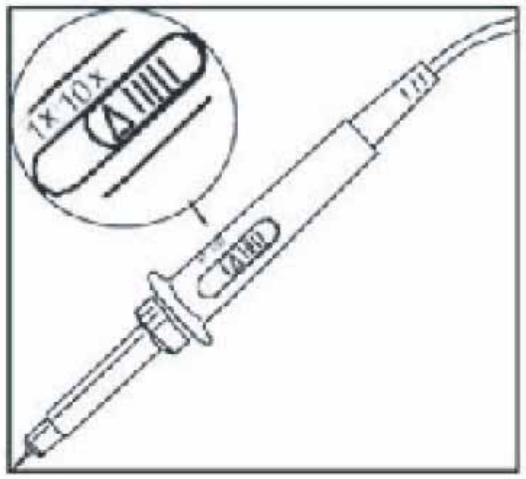


Figure 1－5 Setup of attenuation ratio switch on probe

② In digital storage oscilloscope to set the probe attenuation factor. The attenuation coefficient of vertical gear ratio change instruments, which makes measurement resultsSetup method of attenuation coefficient of probe is as follows to show amplitude of measured signals correctly. Please press F4 key for menu display of 10×

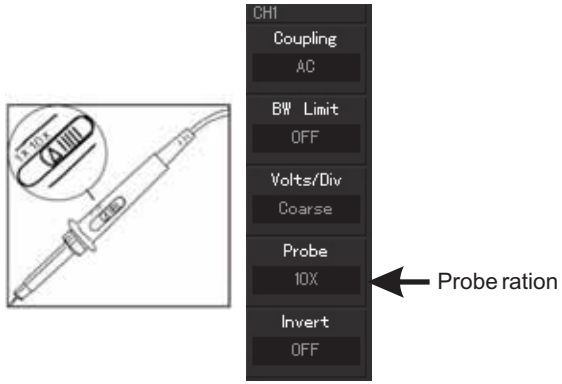


Figure 1-6 Setup of deflection coefficient of probe on digital storage oscillograph

③ Connect probe and grounding clip to corresponding connection ends then press [AUTO] button. As shown in Figure 1-7, square wave (1kHz, about 3V and peak value) can be displayed within several seconds. It has to inspect CH2 by the same method then press [OFF] function button so as to power off CH1. It has to press [CH2] function button to power on CH2 and repeat the second and third steps.

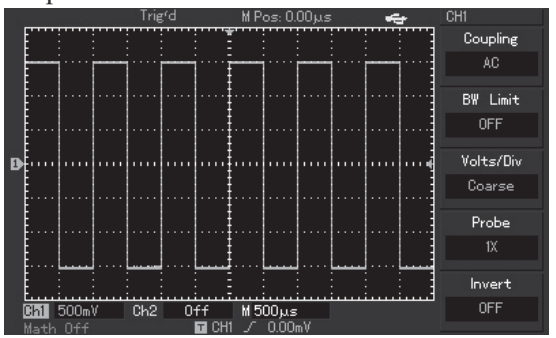


Figure 1－7

Probe compensation

It needs to adjust it when connecting probe to any input channel for the first time so that probe can be appropriate to input channel. Probe without compensation correction can also bring in measurement tolerance or error. Please operate according to following steps for adjustment of probe compensation:

1. To set probe menu attenuation coefficient to 10× and place probe switch to 10× then connect digital storage oscillograph probe to CH1. Please guarantee reliable contact to probe. It has to connect probe end to signal output connector of probe compensator then connect grounding clip to earth wire connector of probe compensator. It also has to power on CH1 and press [AUTO].

2. **Observation of displayed waveform**

compensation Figure 1－8
Compensation correction of probe

3. Adjust variable capacitance on the probe by screwdriver of non-metallic handle for waveform display of “insufficient compensation” or “excessive compensation” shown in above figure until “correct compensation” for waveform display on the screen as above.

Warning: Please guarantee perfect insulation conduits of probe and do not contact metallic part of probe when connecting to HV source to avoid electric shock of probe during HV measurement.

Automatic setup of waveform display

UTD2000/3000 series digital storage oscillograph has automatic setup functions. It can adjust vertical deflection coefficient, scanning time base and trigger mode automatically according to input signal for the most appropriate waveform display. Frequency of measured signals shall be more than or equal to 50Hz and duty cycle shall exceed 1% according to automatic setup requirements.

Automatic setup：

1. Connect measured signals to signal input channel.
2. Press [AUTO] button so that digital storage oscillograph can set vertical deflection coefficient, scanning time base and trigger mode automatically. They can be adjusted again after careful observation and automatic setup so that waveform display can realize the best effect.

Elementary understanding of vertical system

As shown in the following figure, there are a series of keys and knobs in vertical control area. Please introduce usage of vertical setup gradually as follows.

5.7-inch vertical control panel of screen

7-inch vertical control panel of screen

Figure 1－9 Vertical control area on the panel

1. Use vertical position knob so that middle display of waveform signal in the window. Vertical display position of signal can be controlled by vertical position knob.
Ground mark moves vertically with waveform when rotating vertical position knob.

Measurement knack
You can observe difference between waveform and signal ground to measure DC component of signal quickly if adopting DC channel coupling mode. DC components in the signal will be filtered if adopting AC coupling mode . You can also display AC component of signal by higher sensitivity conveniently.

Vertical position of double analog channels shall be restored to short-cut key of zero pointnamely, SET TO ZERO.
The key is to return vertical displacement/horizontal displacement/hold off position to zero point (or middle point).
Of which: UTD2000L series will trigger electric level Return to 50% of position.

2. Alter vertical setup and observe alternation of status information. You can determine variation of any vertical gear by status bar below waveform window. Vertical gear of “volt/grid” can be altered by rotating vertical scale knob to show corresponding variation for channel gear display which corresponds to status bar. User can press [CH1], [CH2] , [MATH] and [REF] to display operation menu, mark, and waveform and gear status information of corresponding channels.

Users can also press [OFF] key to close currently selected channels for UTD2000C/3000C and UTD2000E/3000E oscillograph. They can also click on CH1, CH2 and MATH keys twice to close corresponding channels for UTD2000L oscillograph.

Elementary understanding of horizontal system

As shown in following figure, there is 1 key and 2 knobs in horizontal control area. Please be familiar with setup of horizontal time base gradually as follows:

Horizontal control panel of 5.7-inch

Horizontal control panel of 7-inch

Figure 1－10 Horizontal control area on the panel

1. Use horizontal SCALE knob to alter horizontal time base gear then observe alternation of status information. To rotate horizontal SCALE knob to alter “s/div” time base gear so as to show corresponding variation of time base gear display for corresponding channels of status bar. Horizontal scanning speed steps from 2ns/div～50s/div by way of 1－2－5 mode.

* Note: Horizontal scanning time base gear varies for UTD2000/3000 series digital storage oscillograph due to different models.

2. Use horizontal POSITION knob to adjust horizontal position of signals in waveform window. To use horizontal POSITION knob to control trigger displacement of signals. Horizontal movement of waveform with knob can be observed when rotating horizontal POSITION knob for application for trigger displacement.

3. Please press [MENU] button for 5.7-inch oscillograph (and press [HORI MENU] button for 7-inch oscillograph) to display Zoom menu. Please press [F3] to open view window extension under this menu then press [F1] to close view window extension and return to main time base. Hold off time can be set under this menu.

Trigger point can be restored to vertical middle point quickly by short-cut key of [SET TO ZERO] so as to restoring displacement of trigger point to horizontal zero point short-cut key. Users can also adjust horizontal position of signal in waveform window by rotating horizontal POSITION knob.

Term explanation

Trigger point: It refers to position of actual trigger point by comparing with middle point of storage instrument. Users can move trigger horizontally by rotating horizontal POSITION knob.

Hold off: It refers to interval to start up trigger circuit again.

Hold off time can be set by rotating multi-purpose knob controller.

Elementary understanding of trigger system

As shown in Figure 1－11, there is 1 knob and 3 (or 2) keys in control area of trigger menu. Please be familiar with setup of trigger system gradually as follows:

5.7-inch screen 7-inch screen

Figure 1-12 Trigger menu

Figure 1－11 Trigger menu on the panel

1. To user trigger level knob to alter trigger level and instruct trigger level line by seeing trigger mark on the screen so that it moves vertically with knob rotation. Variation of trigger level in lower part of screen can be observed when moving trigger level at the same time.
2. (As shown in Figure 1-12,) TRIGGER MENU can be used to alter trigger setup.
User can press [F1] key to select “edge” trigger.
They can press [F2]key to select “trigger source” to CH1.
They can press [F3] key to set “gradient” of edge type to ascending.
They can press [F4]key to set “trigger mode” to automatic. They can also press F5 key to set “trigger coupling” to AC.
3. They can press [50%] button for 5.7-inch oscillograph and press [SET TO ZERO] key for 7-inch oscillograph. It also has to set vertical middle point of trigger level in trigger signal amplitude.
4. To press FORCE button: To produce 1 trigger signal forcefully for mainly application for normal and single trigger mode.

Chapter 2: Instrument Setup

By now, you have been familiar with operation of vertical control area, horizontal control area and trigger system menu for UTD2000/3000 series digital storage oscillograph preliminarily. You should be familiar with setup of digital storage oscillograph by menu operation by introduction shown in previous chapter. It is suggested to read Chapter 1 if you have not been familiar with above operation and methods. The chapter is mainly to introduce following themes：

■ Set vertical systems of [CH1],]CH2],] MATH],]REF] ,]OFF]]VERTICAL POSITION] and]VERTICAL SCALE];

■ Set horizontal systems of]MENU] or]HOR MENU],]HORIZONTAL POSITION] or [HORIZONTAL SCALE];

■ Set trigger systems of [TRIGGER LEVEL], [MENU],]50%] and] FORCE];

■ Set sampling mode of [ACQUIRE];

■ Set display mode of [DISPLAY];

■ Store and call-out for [STORAGE];

■ Set auxiliary system of [UTILITY];

■ Automatic measurement of [MEASURE];

■ Cursor measurement of [CURSOR];

■ Use execution buttons of [AUTO] and [RUN/STOP];

It is suggested to read the chapter carefully to know many measurement functions for UTD2000/3000 and system operation method.

Setup of vertical system

CH1 and CH2 channels and setup

Every channel has its own vertical menu. Every item can be set individually according to different channels. As shown in Form 2-1, the system can display operation menu of CH1 or CH2 channel by pressing CH1 or CH2 function key.

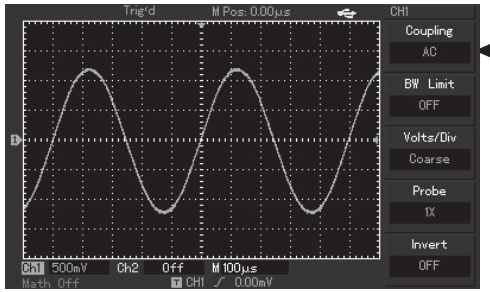
Form 2-1

Function menu	Setup	Description
Coupling	AC DC Grounding	To obstruct DC component of input signal. To cut off input signals by AC and DC components of input signals.
Bandwidth limit	ON OFF	To limit band width to 20MHz so as to reduce display noise. Full band width
Volt/grid	Coarse tuning Fine tuning	To set vertical deflection coefficient for coarse tuning by 1-2-5 system. To refine within setup scope of coarse tuning for fine tuning so as to improve vertical resolution.
Probe	1× 10× 100× 1000×	To select one value according to probe attenuation coefficient to keep correct vertical deflection coefficient. There are totally 4 kinds, namely, 1×, 10×, 100× and 1000×.
Reverse phase	ON OFF	To realize reverse direction function for waveform; To display waveform normally.

1. **Setup of channel coupling**:

Measured signal is a sine signal with DC component by taking exerting signal to CH1 channel as an example.

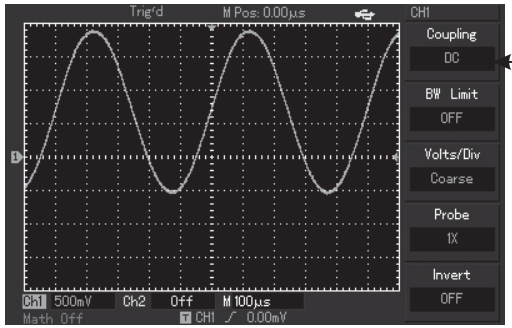
To press F1 to select AC and AC coupling mode. DC component contained by measured signal will be obstructed. Waveform display is shown in following figure.



Setup of AC coupling

Figure 2－1 Jammed DC component of signal

Press F1 to DC to pass through DC and AC components of measured signals of CH1 channel. Waveform display is also shown in following figure:



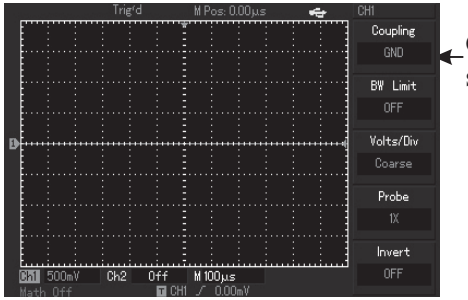
DC coupling setup

Figure 2－2 Synchronous display of DC and AC components of signal

Press［F1］to select grounding and set channels to grounding mode. DC and AC components contained by measured signals will be obstructed. Waveform display is shown in following figure:

displayed on the screen.）

(Note: Input signal still shall be connected to channel circuit under such mode although waveform is not

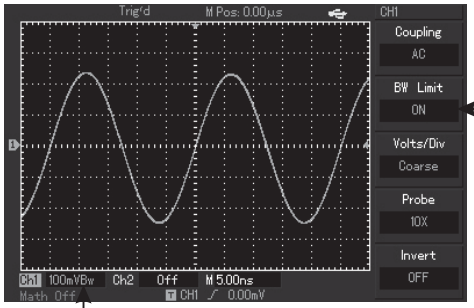


Ground coupling setup

Figure 2－3 Synchronous obstruction of DC and AC components of signal

2. Setup of channel bandwidth limit：

Input one sine signal of about 40MHz for CH1 as an example. It has to press [CH1] to open CH1 channel then press [F2] to set bandwidth limit to OFF. Channel band width is full band width to pass through high-frequency components contained by measured signal. Waveform display is also shown in following figure.

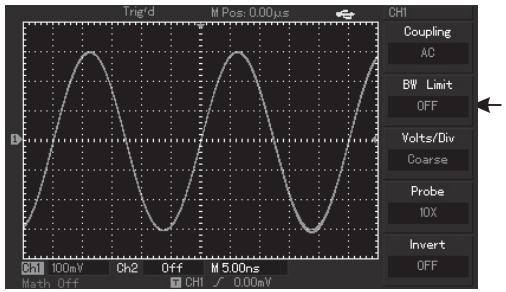


Bandwidth suppression 20MHz

Bandwidth suppression icon

Figure 2－4 Waveform display when closing bandwidth limit

Please press [F2] to set band width limitation to ON for great attenuation of high-frequency component and noise of more than 20MHz contained by measured signals. Waveform display is also shown in following figure.



Close bandwidth limit

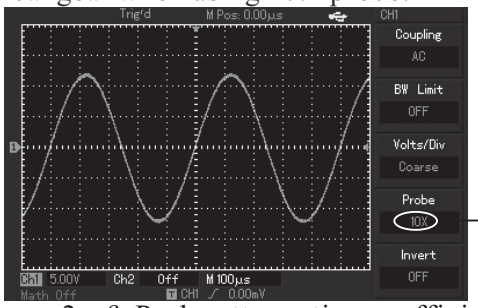
Figure 2－5Waveform display when opening bandwidth limit

3. Setup of multiplying factor for probe：

It has to set probe attenuation coefficient in operation menu of channel to coordinate with attenuation coefficient setup of probe. Probe coefficient in channel menu shall be set to 10× if probe attenuation coefficient is 10:1. It has to analogize to guarantee correct voltage.

Volt/grid gears of vertical deflection coefficient can be divided into coarse tuning and fine tuning.

Please refer to following figure for setup and vertical gear when using 10:1 probe.

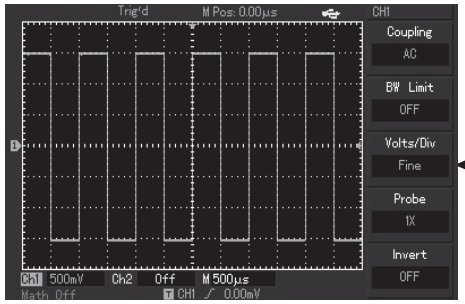


Probe attenuation coefficient

Figure 2－6 Probe attenuation coefficient shown in channel menu

4. Regulation setup of vertical volt/grid：

Volt/grid scope is 2mV/div～5V/div (or 10V/div), or 1mV/div～20V/div with step by way of 1－2－5. Deflection coefficient shall be altered within current vertical gear scope by less step during fine tuning so as to realize uninterrupted and continuous adjustment of vertical deflection coefficient within all vertical gears.



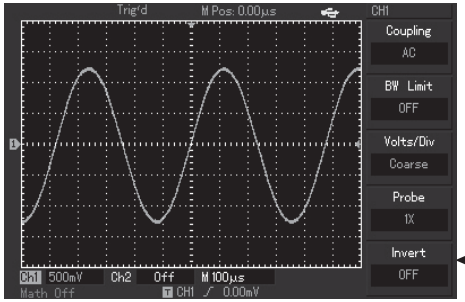
Setup of fine tuning

Figure 2－7 Coarse tuning and fine tuning of vertical deflection coefficient

5. Setup of reverse phase of waveform

Reverse phase of waveform:

It is to show overturning degree of phase location of displayed signals. Please refer to Figure 2－8 for waveform without reverse phase. Please refer to Figure 2－9 for waveform with reverse phase.



Without reverse phase

Figure 2－8 Setup of reverse phase of vertical channel (or without reverse phase)

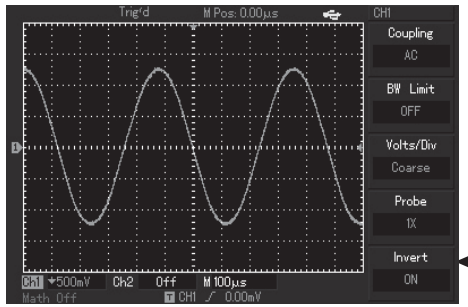


Figure 2－9 Setup of reverse phase of vertical channel

I. Realization of mathematical calculation function

Mathematical calculation functions are to show +, -, ×, / as well as FFT calculation results for CH1 and CH2 channel waveform. Menu is shown as follows:

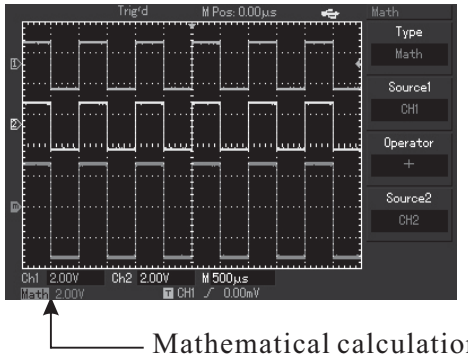


Figure 2－10 Mathematical calculation

Form 2-2: Introduction to mathematical calculation

Function Menu	Setup	Description
Type	Math	+, -, ×, ÷
Information source	CH1	To set information source 1 as Ch1 channel waveform.
	CH2	To set information source 1 as Ch2 channel waveform.
Operator	+	Information source 1 + Information source 2
	-	Information source 1 - Information source 2
	×	Information source 1 × Information source 2
	÷	Information source 1 ÷ Information source 2
Information source 2	CH1	To set information source 2 as CH1 channel waveform.
	CH2	To set information source 2 as CH2 channel waveform.

Analysis of FFT frequency spectrum

Time domain signal can be converted to frequency domain signal when using mathematical calculation of fast Fourier transtable (FFT). Following types of signals can be observed conveniently by using FFT：

- Measure harmonic content and distortion within measurement system;
- Show noise characteristics in DC power;
- Analyze vibration;

Form 2-3: FFT menu Description

Function	Setup	Description
Type	FFT	FFT mathematical calculation
Information source	CH1 CH2	To set CH1 and CH2 as calculation waveform.
Window	Hanning	Set Hanning window function
	Hamming	Set Hamming window function
	Blackman	Set Blackman window function
	Rectangle	Set Rectangle window function
Vertical unit	Vrms dBVrm	To set vertical unit to Vrms or dBVrms.

FFT operation knack:

Signals with DC component or deviation will bring in error or deviation of FFT waveform component. AC coupling mode can be selected to reduce DC component.

Average obtainment mode of digital storage oscillograph can be set to reduce random noise and aliasing frequency component of repeated or single pulse event.

Selection of FFT window

Mathematical storage oscillograph will carry out FFT conversion for time record with limited length when assuming continuous repetition of YT waveform. YT waveform will have the same amplitude in beginning and ending locations for no interruption. However, high-frequency transient interruption will be caused in connector due to different waveform amplitudes for non-integral cycle of YT waveform. Such effect shall be called as leakage in frequency domain. Therefore, value in forced beginning and ending locations is 0 by multiplying original waveform by a window function to avoid leakage. Please refer to following form for application of window function.

Form 2-4

FFT window	Characteristics	The most appropriate measurement content
Rectangle	The best frequency and the poorest amplitude resolution to be basically similar to circumstances without window;	Transient or short impulse with basically equivalent signal level; Sine with equivalent amplitude with similar frequency; Wide band random noise of wave spectrum with slow variation;
Hanning	With excellent frequency resolution and poor amplitude resolution by comparing with rectangular window;	Sine, cycle and narrow band random noise
Hamming	Frequency resolution of Hamming window is better than that of Hanning window slightly.	Transient or short impulse with large difference for signal level;
Blackman	The best amplitude resolution and the poorest frequency resolution	Mainly used for single-frequency signal to search for higher order of harmonic wave.

Term explanation:

FFT resolution: It is defined as factor of sampling and calculation point. FFT resolution increases when sampling rate decreases for fixed calculation point quantity.

Nyquist frequency: Original waveform can not be reset until using sampling rate of at least 2f for waveform with the maximum frequency of "f". It is also called as Nyquist guideline. "f" refers to Nyquist frequency and "2f" refers to Nyquist sampling rate.

Reference waveform

Please refer to waveform stored in nonvolatile memory (NVM) of digital storage oscillograph or peripheral U disk with name of RefA and RefB as follows. Please operate according to following steps to call out or close reference waveform.

5. Please press REF menu key on the front panel for 5.7-screen oscillograph ;

Please press [STORAGE]key and enter into the second page to select call-out for 7-inch oscillograph (namely, UTD2000L series).

2. Please press [RefA] (RefA reference option) and select information source then select its position by rotating multi-purpose knob in upper part of front panel. 1～10 (or 1～20) can be selected for the position. Press "call-out" to call out waveform which is stored inthe position originally after selecting a certain position such as "1". Please plug in U disk if waveform is stored in the U disk. There are 2 options for magnetic disk as follows: DSO/USB; Please press [F2] key and select USB. (The menu can not be activated until plugging in U disk.) Called out waveform is displayed on the screen for waveform called out and stored from U disk. Please press cancel key (F5) Return to previous menu after waveform call-out.

3. To press [RefB] (RefB reference option) and select

information source 2 which participates in calculation and method is the same to the secondstep. Please measure and observe related waveform by UTD2000/3000 series digital storage oscillograph during actual application. Please compare current waveform with reference waveform for analysis. Please press REF key to display reference waveform menu. Setup is also shown in following form.

Form 2-5 Selection of storage position

Function menu	Setup	Description
Storage position	1~20	1~20refer to positions of 20 groups of waveform respectively; There are 200 groups of waveform positions for storage to USB; (Storage position and quantity vary withmachine model.)
Magnetic disk	DSO USB	To select internal storage position; To select external storageposition (until plugging inU disk);
Close		To close called out waveform;
Callout		To call out selected waveform;
Cancel		Return to previous menu;

It is allowed to select from 1 to 20 for internal storage position. Please plug in U disk and press F2 to select USB magnetic disk for external storage instrument. Please refer to STORAGE menu for waveform storage.

Setup of horizontal system

Horizontal control knob

Control knob on horizontal surface can be used to alter horizontal scale (or time base) to trigger horizontal position (or trigger position) shown in RAM. Vertical middle point toward horizontal direction on the screen is time reference point for waveform. Horizontal scale can be altered for waveform extension or shrinkage by comparing with screen center. Horizontal position can also alter by comparing with position of waveform trigger point.

Horizontal position: To adjust horizontal position of channel waveform (including mathematical calculation). Resolution of such control key varies according to time base.

Horizontal scale: To adjust main time base, namely, s/div. Window width can vary with delay scanning time base by rotating horizontal scale knob when opening extension time base. Please refer to introduction to extension time base for details. (As shown in the following form), horizontal menu can be displayed for horizontal control key menu.

Form 2-6

Function menu	Setup	Description
Main time base	——	1.To open main time base; 2.To close view window extension according to main time base after opening;
——		
View window extension	——	To open extension time base;
——		
Hold off	——	To regulate inhibition period;

Figure 2-11 Interface of horizontal system

Mark Description:

①. Mark represents position of current waveform view window in RAM

②. Mark position of trigger point in RAM.

③. Mark position of trigger point in current waveform view window.

④. Display horizontal time base (or main time base), namely, s/div.

⑤. Trigger horizontal distance of position by comparing with middle point of view window.

Term explanation:

Y-T mode: Y axle refers to voltage and X axle refers to time quantum under this mode.

X-Y mode: X axle refers to CH1 voltage and Y axle refers to CH2 voltage under this mode.

Slow scanning mode: Instrument will enter into slow scanning sampling mode when setting horizontal time base control to 100ms/div or less. It is suggested to set channel coupling to DC when observing low-frequency signal by applying for slow scanning mode.

s-div: Time base control can expand or compress waveform for horizontal scale (or time base) unit if stopping waveform sampling (by using RUN/STOP key).

View window extension

View window extension is to argument a section of waveform to review image details conveniently. Setup of view window extension can not be slower than that of main time base.

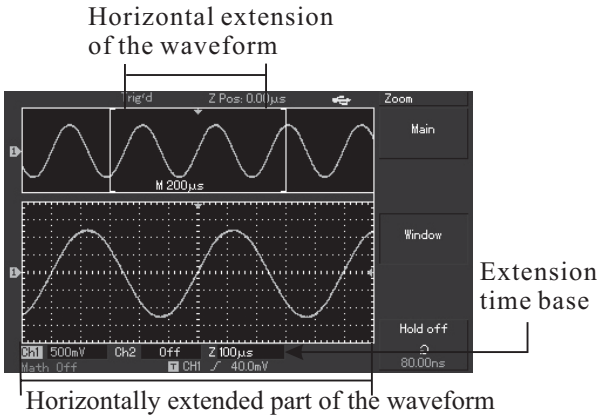


Figure 2－12 Screen display under view window extension

(As shown in above figure), it can be divided into 2 display areas under extension time base. Original waveform is displayed for upper part. Selected area can move horizontally by rotating horizontal POSITION knob or increase or decrease by rotating horizontal SCALE knob.

Waveform with horizontal extension in originally selected waveform area is shown in lower part. (As shown in above figure,) please pay attention that resolution increases for extension time base by comparing with main time base. Waveform displayed by the entire lower party corresponds to area selected for upper part so users can rotate horizontal SCALE knob to reduce selected area and increase extension time base, namely, horizontal extension multiple of waveform.

The mode must be used for CH1 and CH2 at the same time. CH1 voltage will be displayed on X axle and CH2 voltage

will be displayed on Y axle after selecting X-Y display mode.

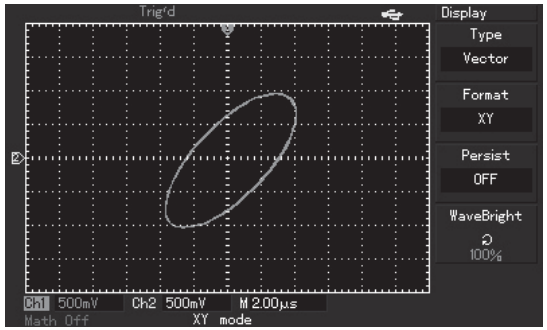


Figure 2－13 Waveform display under X-Y mode

Note: Digital storage oscillograph can capture waveform by any sampling speed under normal X-Y mode. Similarly, it is allowed to adjust sampling rate, vertical gear of channels and time base gear under X-Y mode. Default sampling rate is 100MS/s under X-Y mode. In general, sampling rate can reduce to gain excellent Lissajou's figure. Following functions do not effect during X-Y display.

- Automatic testing mode
- Cursor measurement mode
- Reference or mathematical calculation waveform
- View window extension function
- Trigger control

Setup of trigger system

Trigger can determine data acquisition time and waveform display for digital storage oscillograph. It can convert instable display to meaningful waveform once correct setup. Digital storage oscillograph will collect sufficient data to map waveform in the left side of trigger point firstly. It will acquire data continuously and synchronously when waiting for trigger conditions. It also will acquire sufficient data continuously to map waveform in the right side of trigger point. Trigger control area of operation panel of digital storage oscillograph includes trigger level adjustment knob and trigger menu key of [TRIG MENU];

5.7-inch oscillograph will set 50% of trigger level in vertical middle point of signal (and realize UTD2000L by press [SET TO ZERO] key). It has to press forced trigger key of [FORCE].

Trigger level: Trigger level will set signal voltage which corresponds to trigger point.

50%: To set trigger level to vertical point of trigger signal amplitude.

FORCE: To produce 1 trigger signal forcefully for mainly application for normal and single modes shown in trigger modes.

TRIG MENU: To trigger and set menu key.

Trigger control

Trigger mode: Edge, pulse width, video and ALT TRIG;

Edge trigger: Trigger when edge of trigger signal reaches a certain given level.

Pulse width trigger: Trigger when pulse width of trigger signal reaches certain set trigger conditions

Video trigger: Carry out field or line trigger for standard video signals. (UTD2000L series have not such function except UTD2025CL.)

ALT TRIG: It is appropriate to trigger signal without frequency relevance. Various kinds of trigger menus are also shown as follows:

Edge trigger:

Edge trigger mode is to trigger threshold value of input signal edge. That is, to trigger in ascending/ descending edge of input signal when selecting “edge trigger”.

Form 2-7

Function menu	Setup	Description
Type	Edge	
Selection of information source	CH1 CH2 EXT EXT/5 Municipal power Alteration	Set CH1 as trigger signal of information source. et CH2 as trigger signal of information source. Set EXT TRIG INPUT channel as trigger signal of information source. Divide outer trigger source by 5 to expand outer trigger level scope. Set municipal power trigger ALT TRIG of CH1 and CH2 signals;.
Gradient	Ascend Descend Ascend/descend	Set ascending edge trigger for signal; Set descending edge trigger for signal; Set ascending/descending edge trigger of signal;
Trigger mode	Automatic Normal Single	Set waveform acquisition without detecting trigger conditions; Set waveform acquisition after meeting trigger conditions; Set sampling of a waveform and shutdown after detecting once trigger;
Trigger coupling	AC DC High-frequency inhibition Low-frequency inhibition	Obstruct DC component of input signal; Pass through AC & DC components of input signal; Inhibit high-frequency components of more than 80kHz for signal; Inhibit low-frequency components of less than 80kHz for signal

Pulse width trigger

Trigger time shall be determined for pulse width trigger according to pulse width. You can capture abnormal pulse by setting pulse width conditions.

Form 2-8 (the first page)

Function menu	Setup	Description
Type	Pulse width	
Selection of information source	CH1 CH2 EXT EXT/5 Municipal power Alteration	To set CH1 as trigger signal of information source. To set CH2 as trigger signal of information source. To set EXT TRIG INPUT channel as trigger signal of information source. To divide outer trigger source by 5 to expand outer trigger level scope. To set municipal power for trigger. ALT TRIG of CH1 and CH2 signals
Pulse width conditions	More than Less than Equal to	To trigger when pulse width exceeds set value; To trigger when pulse width is less than set value; To trigger when pulse width is equivale
Pulse width setup		To set pulse width of 20ns to 10s then regulate by multi-purpose knob in upper part of front panel.
Next page 1/2	——	Enter into next page.

Form 2-9 (the second page)

Function menu	Setup	Description
Type	Pulse width	
Trigger polarity	Positive pulse width Negative pulse width	To set positive pulse width as trigger signal; To set negative pulse width as trigger signal;
Trigger mode	Automatic Normal Single	The system will acquire waveform data automatically and display scanning base line on the screen without trigger signal input. It will convert to trigger scanning automatically when producing trigger signal. To produce trigger scanning if any trigger signal is produced. To produce once trigger then stop during trigger signal input.
Trigger coupling	DC AC High-frequency inhibition	High-frequency inhibitionTo pass through AC & DC components of trigger signal. To obstruct DC components of trigger signal. To obstruct pass through of high-frequency components of signal and only low-frequency components can pass through.
Previous page 2/2	——	Return to previous page.

Video touch

To trigger in field or row with NTSC or PAL standard video signals after selecting video trigger for UTD2025CL oscillograph shown in 5.7-inch or 7-inch screen. Trigger coupling is pre-set to DC. Please refer to following form for trigger menu.

Form 2-10 Setup of video trigger

Function menu	Setup	Description
Type	Pulse width	
Selection of information source	CH1	To set CH1 as trigger signal of information source.
	CH2	To set CH2 as trigger signal of information source.
	EXT	To set EXT TRIG INPUT channel as trigger signal of information source.
	EXT/5	To set 5 times of attenuation for outer trigger signal as trigger signal.
	Alteration	ALT TRIG of CH1 and CH2 signals
Standard	PAL	Video signal to be appropriate to PAL system;
	NTSC	Video signal to be appropriate to NTSC system;
Synchronization	All rows	To set synchronous trigger of video row.
	Designated row	To set synchronous trigger of designated video row for adjustment by multifunctional knob in upper part of front panel.
	Odd field	To set synchronous trigger for video odd field.
	Even field	To set synchronous trigger for video even field.

Please refer to Figure 2-14 for screen display when selecting standard system of PAL and row synchronization as synchronization mode. Please refer to Figure 2-15 for field synchronization of synchronization mode.

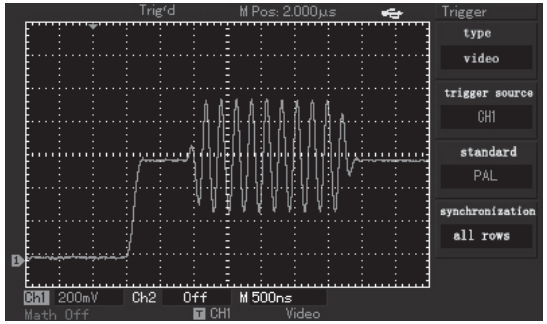


Figure 2－14　Video trigger: Row synchronization

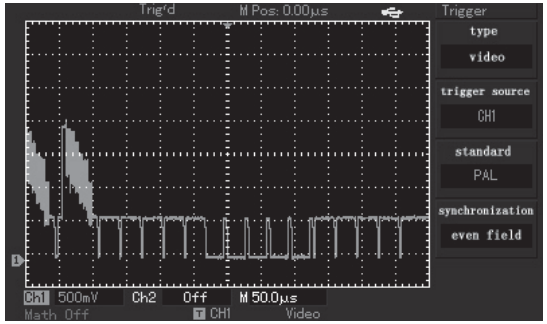


Figure 2－15　Video trigger: Field synchronization

ALT TRIG mode

ALT TRIGTrigger signal comes from 2 vertical channels during ALT TRIG. Such trigger mode can be adopted for synchronous observation of 2 signals without regard to signal frequency. Please refer to following figure for trigger alternation waveform display.

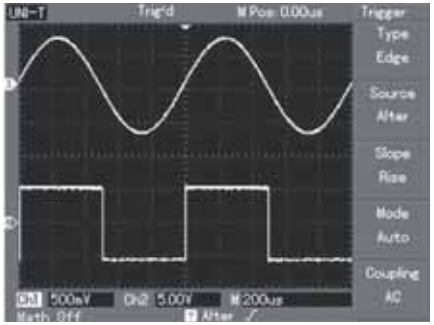


Figure 2－16 Observation of 2 signals with different frequency by.

Form 2-11 Trigger alternation menu

Function menu	Setup	Description
Type	Edge	Set trigger mode to edge
Trigger source	Alternation	ALT TRIG of CH1 and CH2
Gradient	Ascending	Set trigger gradient to ascending edge.
Trigger mode	Automatic	Set trigger mode as automatic one
Trigger coupling	AC	Set trigger coupling mode to AC mode

Setup of trigger coupling mode

Please enter into trigger setup menu for setup of trigger coupling mode and gain the most sform synchronization. Please refer to following form for menu of trigger coupling mode.

Form 2-12

Function menu	Setup	Description
Type	——	
Trigger source	——	
Gradient	——	
Trigger mode	——	
Coupling	AC DC High-frequency inhibition Low-frequencyinhibition	Set pass-through obstruction of DC components. Set pass-through of all components. Obstruct pass-through of high-frequency part of signal. Only low-frequency components can pass through. Obstruct pass-through of low-frequency part of signal. Only high-frequency components can pass through.

Adjustment of hold off time

Adjustment of hold off time can be used to observe complex waveform (such as pulse string series). Inhibition time refers to waiting period of digital storage oscillograph to start up trigger circuit again. Digital storage oscillograph will not trigger until inhibition time ends during inhibition period. For instance, as shown in Figure 2-17, the first pulse among a group of pulse series shall be triggered to set inhibition time to width of pulse string.

Please refer to following form for hold off menu.

Form 2-13

Function menu	Setup	Description
Main time base	——	1. To open main time base; 2. To close view window extension according to main time base after opening view window extension.
——		
View window extension	——	To open extension time base.
——		
Hold off		To adjust inhibition time.

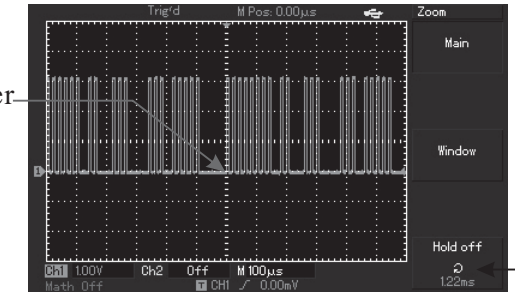


Figure 2—17 Hold off used for synchronization of complex waveform

Operation Description

1. To select edge, trigger source and gradient shown in TRIG MENU according to synchronization mode of normal signal then adjust trigger level for stable waveform display as practicable as possible.

2. To press HORI MENU key to display horizontal menu.

3. To adjust multi-purpose knob in upper part of panel to alter inhibition time for stable waveform display as practicable as possible.

Term explanations

1. Trigger source: To gain trigger from many kinds of information sources, namely, input channel (CH1 & CH2), external trigger (EXT & EXT/5) and municipal power.

■ Input channel: The most common trigger information source is (optional) input channel. Selected one is used as channel of trigger information source for normal operation regardless of input display.

■ External trigger: Such trigger information source can be used for trigger on the third information channel during synchronous data acquisition on 2 channels. For instance, signals from external clock or circuit to measure can be used as trigger information source. EXT and EXT/5 trigger sources shall use external trigger

connected to EXT TRIG interface. Signal can be used for EXT and EXT can be used within signal trigger level scope of -3V to +3V.
It is allowed to select EXT/5 for oscillograph of 5.7-inch screen. Outer trigger shall be divided by 5 so that trigger scope can expand to -15V to +15V for trigger of digital storage oscillograph under large signal.

■ Municipal power: Such trigger mode can be used to observe signal with regard to municipal power. For instance, it can provide relationship between lighting equipment and power supply equipment so as to gain stable synchronization.

2． Trigger mode: It is to determine behavior mode of digital storage oscillograph without trigger event. This digital storage oscillograph can also provide 3 triggers, namely, automatic, normal and single trigger modes.

■ Automatic trigger: The system will acquire waveform data automatically so as to display scanning base line on the screen without trigger signal input. It will convert to trigger scanning automatically for signal synchronization when producing trigger signal.

Note: Without trigger signal is allowed under “ automatic” mode when setting scanning waveform to 5-ms/div or less time base.

■ Normal trigger: Digital storage oscillograph can not acquire waveform until meeting trigger conditions under ordinary trigger mode. Trigger scanning can be produced when producing trigger signal.

■ Single trigger: User can press “operation” button once under single trigger mode for entry and trigger waiting for digital storage oscillograph. It will sample and display all acquired waveform then stop after digital storage oscillograph detects once trigger.

3.Trigger coupling: Trigger coupling can determine category of signal component conveyed to trigger circuit. Coupling types include DC, AC, low-frequency inhibition and high-frequency inhibition.

■ Pass through all components of signals under DC mode.

■ Obstruct DC components with signal attenuation to be less than 400Hz under AC mode.

■ Obstruct DC components with attenuation of low-frequency component of less than 80kHz under “low-frequency inhibition” mode.

■ Attenuate high-frequency components of more than 80kHz under “high-frequency inhibition” mode.

4. Pre-trigger/delay trigger: To trigger data acquired in ahead/after event. Trigger position is often set in the horizontal center on the screen. You can observe pre-trigger and delay information of 5div (or 6div). You can also rotate horizontal position to regulate horizontal displacement of waveform and review more pre-trigger details. You can observe waveform in ahead of trigger by observing pre-trigger data. For instance, burring reason can be shown by observation and analysis on pre-trigger data after capturing burring during circuit startup.

Setup of sampling system

As shown in following figure, ACQUIRE in control area is function key of sampling system.

Figure 2–18 Function key of sampling system

User can use ACQUIRE key to pop out sampling setup menu so as to adjust sampling mode by control button shown in the menu.

Form 2-14 Sampling menu

Function menu	Setup	Description
Obtainment mode	Sampling Peak-value detection Average	Activate ordinary sampling mode. Activate peak-value detection mode. Set average sampling mode and display average times.
Average times	2~256	Set average times for step by multiples of 2, namely, 2, 4, 8, 16, 32, 64, 128 and 256. As shown in Figure 2-18, average times can alter by pressing left multi-purpose knob.
Sampling mode	Real-time Equivalent	Set sampling mode to real-time sampling mode. Set sampling mode to equivalent sampling mode.
Fast acquisition	ON	Acquire by higher screen refreshing rate to reflect dynamic effect of waveform excellently. Close fast acquisition.

It has to observe waveform display variation by altering obtainment mode. Please refer to Figure 2-19 and 2-20 for sampled waveform display if signal contains large noise when adopting 32 times of average mode or without adopting average mode.

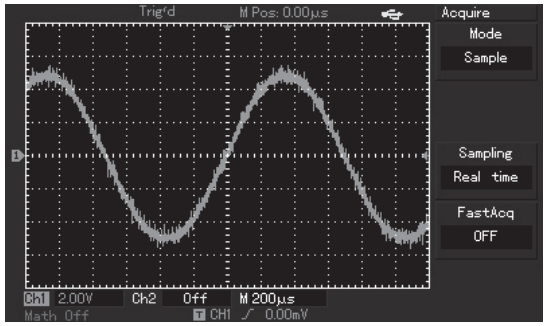


Figure 2－19 Waveform without adopting

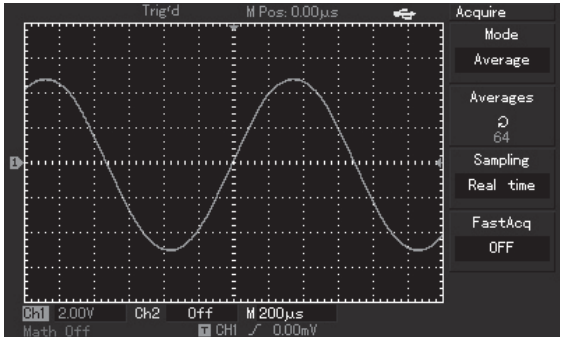


Figure 2-20 Waveform by adopting 32 times of average mode

Note：

1. Please select real-time sampling mode for observation of single signal.
2. Please select equivalent sampling mode for observation of high-frequency periodic signal.
3. Please select peak-value detection mode to avoid mixed signal envelope. Please select average sampling mode with step of multiples of 2 for average value to reduce random noise of displayed signal. Average times can be selected form 2 to 256.

Term explanation

Real-time sampling: It refers to data required for once acquisition.

Equivalent sampling: It refers to repeated sampling mode. It can facilitate careful observation of repeated periodic signals. It can be adopted to gain horizontal resolution which is higher than real-time sampling resolution greatly.

Sampling mode: It can be classified into equivalent and real-time modes.

Peak-value detection mode:

Digital storage oscillograph will find out the maximum and minimum input signals within every sampling interval for waveform display by using such values under such obtainment mode. It can also obtain and display narrow impulse or they may be omitted for larger noise under such mode. Average mode is as follows: Digital storage oscillograph may obtain several waveform and calculate average value then display final waveform under this obtainment mode. Such mode can be adopted to reduce random noise.

Setup of display system

As shown in following figure, DISPLAY in control area is function key of display system

Figure 2－21 Function key of sampling system

Please press DISPLAY button to pop out setup menu shown in following figure. Display mode can be adjusted by pressing menu control button.

Form 2-15 Display menu

Function menu	Setup	Descriptions
Display type	Vector point	Only to display sampling points by wiring.
Format	YT XY	Operation mode of digital storage oscillograph X-Y display mode; X input for CH1 and Y input for CH2;
Continuous	Close 1s 2s 5s Infinite	Real-time updating of screen waveform; To update after keeping waveform data shown in the screen for 1s; To update after keeping waveform data shown in the screen for 2s; To update after keeping waveform data shown in the screen for 5s; To always keep display of original waveform data shown in the screen until this function is inactivated if new data is added into display continuously;
Waveform brightness	1% - 100%	To set waveform brightness (without this function for UTD2000C/3000C)

Key points:
Display type: To fill in blank between adjacent sampling points during vector display. Only sampling points will be displayed for point display.

Storage and callout

As shown in following figure, STORAGE in MENU control area is function key of storage system.

Figure 2－22 Function key (storage) for sampling system

STORAGE key can be used to display storage setup menu. You can save oscillograph waveform or setup status to internal storage area or U disk to call out saved waveform by RefA (or RefB) or call out setup status by STORAGE key. Waveform display area of oscillograph can be saved to DSO contents in U disk in a form of bitmap. Saved bitmap can be read by PC computer.

Operation steps：

Please press STORAGE Enter into type menus. There are 3 types, namely, waveform, setup and bitmap.

2. Please refer to Figure 2-16 for selection of type waveform and entry into following waveform storage menu. Please call out REF (reference waveform shown in the second page) from Section 2 of the chapter after saving waveform.

Form 2-16 Waveform storage menu (the first page)

Form 2-16

Function menu	Setup	Description
Type	Waveform	Select waveform storage and callout menu
Information source	CH1 CH2	Select waveform from CH1 channel. Select waveform from CH2 channel.
Storage position	1~20	1~20 refer to positions to store 20 groups of waveform. There are 200 groups of waveform positions for storage to SUB. (Storage position and quantity vary with machine model.)
Save	——	Save waveform
Next page 1/2	——	Enter into next page.

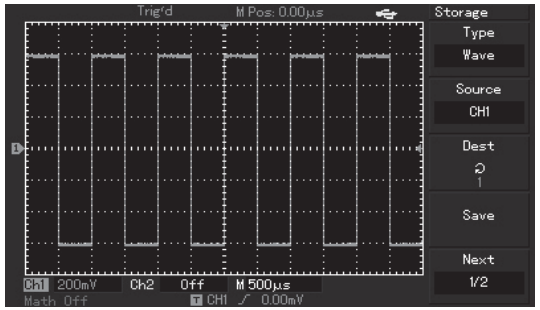


Figure 2-23 Waveform storage

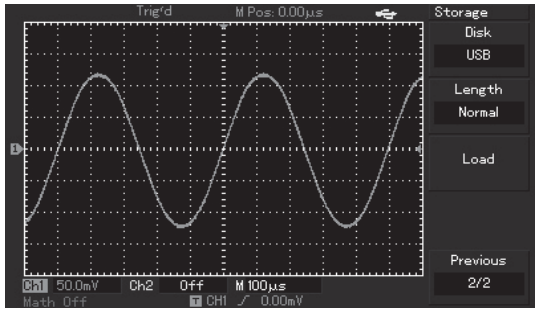


Figure 2-24 Waveform storage by U disk

Form 2-17 Storage menu (the second page)

Function menu	Setup	Description
Magnetic disk	DSO USB	To select internal RAM of digital storage oscillograph then select external U disk. (This function can not be used until plugging in U disk.)
Storage depth	Ordinary Long storage	To set storage depth to ordinary; (Callout only can be done in REF area when saving data to U disk.) To set storage depth to long storage. (Note: This function can not be activated until plugging in U disk. Callout can not be done until using loading function of computer communication software or waveform analysis load when saving data to U disk.)
Previous page 2/2	——	Return to previous page.

2. As shown in Form 2-18, please select setup and enter into setup storage menu.

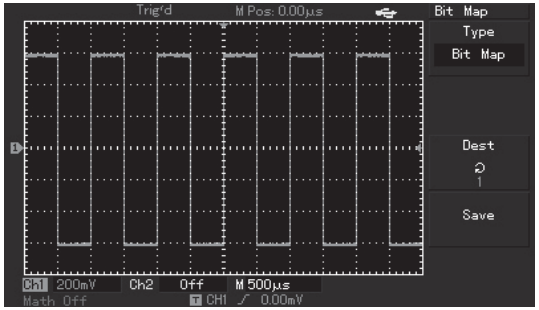


Figure 2-25 Storage setup

Form 2-18 Setup of storage menu

Function menu	Setup	Description
Setup		To select panel setup menu.
Setup of (storage position)	1～20	Operation setup to save 20 groups of panels: To select by multi-purpose knob in upper part of front panel. (Position and quantity vary with machine model
Save		Storage setup
Recall		Callout setup

3. As shown in Form 2-19, please select bitmap for entry into bitmap storage menu.
Remark: This function can not be called out until plugging in U disk.
Form 2-19 Bitmap storage menu

Function menu	Setup	Description
Bitmap		Select bitmap menu
——		
Storage position	1～200	200 bitmap data can be saved by selecting multi-purpose knob in upper part of front panel. (It is 1 to 10 for UTD2000C series.)
Save		Save bitmap data
——		

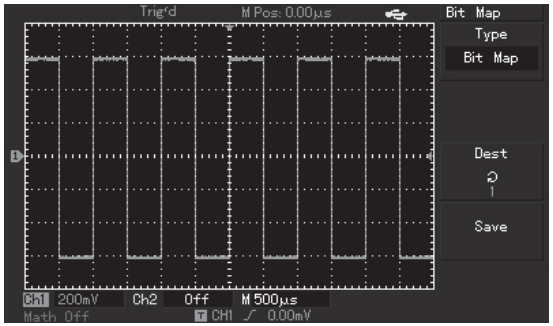


Figure 2-26 Bitmap storage

Setup of auxiliary functions

As shown in following figure, UTILITY in MENU control area is function key.

Figure 2－27 Function key (and function) of sampling

User can press UTILITY key to pop out setup menu of auxiliary system function.

Form 2-20 (the first page)

Function menu	Setup	Description
Self-correction	Execution Cancel	To carry out self-correction. To cancel self-correction and return to previous page.
By detection	Please refer to Form 2-23	To set waveform Pass/Fail. (Only UTD2000E/30003, UTD2025C/3025C and UTD2025CL have this function.)
Waveform recording	Please refer to Form 2-22	Set waveform recording operation.
Language	Multilanguage	Select interface language.

Form 2-21-1 (the second page)

Function menu	Setup	Description
Fast correction	ON/OFF	Activate/inactivate fast correction function of channels within scope of 2mV/div to 10 mV/div. (Only UTD2025C/3025C has this function.)
Interface style	The first style The secondstyle The third style The fourth style	Set 4 interface styles for digital storage oscillograph.
Gridding brightness	1% - 100%	Adjust gridding brightness of the screen by multi-purpose knob. UTD2000C/3000C also has no this function.
Next page 2/3	——	Enter into next page.

Form 2-21-2 (the third page)

Function menu	Setup	Description
System information		Display information of current oscillograph system.
Frequency meter		Activate/inactivate function of frequency meter.
The first page 3/3		Return to the first page.

Form 2-22 Waveform recording menu

Function menu	Setup	Description
Information source	CH1 CH2 CH1+CH2	Select CH1 as recording signal source. Select CH2 as recording signal source. Select ct CH1+CH2 as recording signal source.
Operation	●	Record by pressing recording key for synchronous display of recorded quantity in lower part of the screen.
	▶	1. Playback key; 2. Press the key for playback and display of current playback screen No. in lower right corner of screen. Playback can be stopped by rotating multi-purpose knob controller in upper part of panel. However, waveform of a certain screen can be selected for repeated playback by continuing to rotate it. 3. Press■ to stop then press ▶ for playback of all items.
	■	Stop recording
Save	1 ~ 200	Save newly recorded waveform for U disk plug-in. Storage position can be selected by multi-purpose knob.
Recall	1 ~ 200	Call out recorded waveform from U disk then select recording position by multi-purpose knob.
Return	——	Return to previous level of menu.

Form 2-23 By detection

Function menu	Setup	Description
Detection status	Open Close	Open/close information of waveform pass/fail times
Information source	CH1 CH2 MATH RefA RefB	Select CH1 as detected signal source. Select CH2 as detected signal source. Select MATH as detected signal source. Select RefA as detected signal source. Select RefB as detected signal source.
Output conditions	Pass Pass/Halt Fail/Halt Fail	Output concurrency prompt when detecting waveform pass; Output and pause when detecting waveform pass; Output and pause when detecting waveform fail; Output concurrency when detecting waveform fail;
Template setup	Refer to Form 2-24 for details	Enter into template setup menu.
Return		Return to previous menu.

Form 2-24 Template setup

Function menu	Setup	Description
Template output	/	Set horizontal and vertical Pass/Fail tolerance scope according to adjustment
Horizontal	1-200Pixel	Set horizontal tolerance scope
Vertical	1-100Pixel	Setvertical tolerance scope
Return	/	Return to Pass detection menu

Key note:Key note:

Self-correction: Self-correction procedure is to correct measurement error caused by digital storage oscillograph due to ambient variation. You can operate the procedure according to demand. Please open power of digital storage oscillograph then wait for instrument pre-heating for 30 minutes for more correct calibration. Please press UTILITY key (as an auxiliary function) for operation according to prompt shown in the screen.

Language selection: There are many kinds of languages for UTD2000/3000 series digital storage oscillograph. Please press UTILITY menu button and select appropriate language.

Automatic measurement

As shown in following figure, MEASURE is automatic measurement function key. You can be familiar with powerful automatic measurement function of UTD2000/3000 series digital storage oscillograph gradually by following introduction.

Figure 2-28 Function key (automatic measurement) of sampling system

Application example

Measurement menu of such series of oscillograph can be used to measure 28 kinds of waveform parameters. User can press MEASURE key Enter into parameter measurement display menu firstly. The menu includes 5 areas to display measurement value at the same time. They correspond to function keys of F1 to F5 respectively. Please press corresponding F keys Enter into measurement category selection menu if measurement category shall be selected for any area. Measurement category selection menu can be classified into voltage and time kinds Enter into voltage or time measurement category respectively. Please press F1 to F5 to select measurement category then return to parameter measurement display menu. In addition,user can

press F5 to select “All parameters” to display all voltage/time measurement parameters. User can press F2 to select channel to measure. (Channel is ineffective until opening.) User can press F1 Return to parameter measurement display menu if not altering current measurement category. The first example: Steps are as follows if displaying measured peak value of CH2 channel in F1 area.

1. To press F1 key Enter into measurement category selection menu;
2. To press F2 to select CH2;
3. To press F3 to select voltage;
4. To press F5 (shown in the second page, 2/4) to see that F3 position is “peak value”
5. To press F3 to select “peak value” and return to parameter measurement display menu automatically; Peak value is displayed in F1 area on the homepage of measurement menu.

The secondexample: Setup of delay measurement: Delay measurement function is used for interval between ascending edges of 2 information sources, namely, interval from ascending edge of the first cycle of a certain information source to that of the first cycle of additional information source. Measurement steps are as follows:

1. To refer to above example and select area displayed by delay measurement value after entering into measurement menu (shown in 3/3 page of time category);
2. To select reference information source of CH1 then select delay information source of CH2;
3. To select reference information source of CH1 then select delay information source of CH2;
4. To press F5 to confirm that delay measurement is displayed in selected area.

Automatic measurement of voltage parameters

Voltage parameters which can be measured by UTD2000/3000 series oscillograph automatically are as follows:

Peak value (Vpp): Voltage from the highest waveform point to the lowest waveform point;

The maximum value (Vmax): Voltage from the highest waveform point to GND (ground);

The minimum value (Vmin): Voltage from the lowest waveform point to GND (ground);

Middle value (Vmid): Half of sum of waveform top and bottom voltage;

Amplitude (Vamp): Voltage from waveform top to bottom;

Middle value (Vmid): Half of sum of waveform top and bottom voltage;

Top value (Vtop): Voltage from flat waveform top to GND (ground);

Bottom value (Vbase): Voltage from waveform bottom to GND (ground);

Overshoot: Ratio of difference of the maximum waveform value and top value and amplitude;

Preshoot: Ratio of difference of the minimum waveform value and bottom value and amplitude;

Average value: Average amplitude of signals within a cycle;

Root-mean-square (Vrms): It is effective value. Root-mean-square refers to DC voltage of converted energy within 1 cycle according to AC signal to correspond to equivalent energy.

Automatic measurement of time parameters

UTD2000/3000 series oscillograph can measure signal frequency, cycle, ascending time, descending time, positive pulse width, negative pulse width, delay (of 9 combinations), positive duty cycle, negative duty cycle and 10 time parameters automatically. Definitions of such time parameters are as follows:

RiseTime: It refers to period when waveform amplitude increases from 10% to 90%;

FallTime: It refers to period when waveform amplitude decreases from 90% to 10%;

Positive pulse width (+Width): It refers to pulse width of positive pulse under 50% of amplitude;

Negative pulse width (-Width): It refers to pulse width of negative pulse under 50% of amplitude;

Delay (ascending edge): It refers to delay from ascending edge to ascending edge;

Delay (descending edge): It refers to delay from descending edge to descending edge;

Positive duty cycle (+Duty): It refers to ratio of positive pulse width and cycle;

Negative duty cycle (-Duty): It refers to ratio of negative pulse width and cycle;

Measurement menu

Operation Description: Please press MEASURE key so that the screen can display 5 measurement values. As shown in Form 2-25, user can press any key of F1 to F5 so that the screen enters into measurement selection menu.

Form 2-25

Function menu	Setup	Description
Return		Return to parameter measurement display menu.
Information source	CH1	Select channel of measurement parameters.
	CH2	Select channel of measurement parameters.
Voltage kind		Enter into voltage parameter menu.
Time kind		Enter into time parameter menu.
All parameters		Display/close all measurement parameters.

Of which: Menu included by “voltage kind” is shown in Form 2-26 to 2-29.

Form 2-26

Function/measurement item	Description
Return	Return to menu shown in Form 2-25.
Preshoot	Return to parameter measurement display menu and substitute original position parameter after selection.
Amplitude	he same as above
Overshoot	The same as above
Next page (1/4)	Page turning

Form 2-27

Function/measurement item	Description
Previous page	Return to previous page.
Average value	Return to parameter measurement display menu and substitute original position parameter after selection.
Peak value	he same as above
Root-mean-square	he same as above
Next page (2/4)	Page turning

Form 2-28

Function/measurement item	Description
Previous page	Return to previous page.
Top value	Return to parameter measurement display menu and substitute original position parameter after selection.
Bottom value	The same as above
Middle value	The same as above
Next page (3/4)	Page turning

Form 2-29

Function/measurement item	Description
Previous page	Return to previous page.
The maximum value	Return to parameter measurement display menu and substitute original position parameter after selection.
The minimum value	The same as above
——	——
Next page (4/4)	Return to the first page (shown in Form 2-26)

Menu included by “time category” is shown in Form 2-30 to Form 2-32.

Form 2-30

Function/measurement item	Description
Return	Return to menu shown in Form 2-25.
Frequency	Return to parameter measurement display menu and substitute original position parameter after selection.
Cycle	The same as above
RiseTime	The same as above
Next page (1/3)	Page turning

Form 2-31

Function/measurement item	Description
Previous page	Return to previous page.
Frequency	Return to parameter measurement display menu and substitute original position parameter after selection.
Cycle	The same as above
RiseTime	The same as above
Next page (2/3)	Page turning

Form 2-32

Function/measurement item	Description
Previous page	Return to previous page.
Delay	Enter into delay option menu (shown in Form 2-32a) after selection.
Positive duty cycle	Return to parameter measurement display menu and substitute original position parameter after selection.
Negative duty cycle	The same as above
The first page (3/3)	Return to the first page (shown in Form 2-30).

Form 2-32a

Function	Setup	Description
Channel	CH1/CH2 /MATH	Select measured channel.
Channel	CH1/CH2 /MATH	
——	——	
——	——	
Enter		Return to parameter measurement display menu and substitute original position parameter after selection.

Cursor measurement

User can press CURSOR button to display measurement cursor and cursor menu then use multi-purpose knob controller to alter cursor position. As shown in following figure, CURSOR in MENU control area is cursor measurement function key.

Figure 2-29 Function key (or cursor) of sampling system

User can move cursor for measurement under CURSOR mode. There are 3 modes, namely, voltage, time and tracing. △V can be measured by pressing SELECT and COARSE keys on the panel and multi-purpose knob controller to adjust positions of 2 cursors respectively during voltage measurement. Similarly, it can be measured if selecting time. Cursor of digital storage oscillograph can also trace signal variation automatically under tracing mode with waveform display.

Remark: For 5.7-inch oscillograph

1. Effect of SELECT key is to select the cursor.
2. Effect of COARSE key is to adjust movement speed of cursor.

For 7-inch oscillograph:

User can press multi-function knob key to select the cursor. Movement speed of cursor can also alter according to rotation speed.

1. Voltage/time measurement mode: The first or secondcursor will appear at the same time. Cursor position on the screen can be adjusted by multi-purpose knob controller. User can press SELECT key (or multi-function knob key) to select cursor to adjust. Displayed reading is also time or voltage between 2 cursors.
2. Tracing mode: Horizontal and vertical cursors can intersect to become a crossing cursor. Crossing cursor can position on the waveform automatically to adjust horizontal position of crossing cursor on the waveform by rotating multi-purpose knob controller. Digital storage oscillograph can also display coordinate of cursor point at the same time.
3. Measurement value will be displayed in upper right corner of the screen automatically when opening cursor function.

Usage of operation key

RUN/STOP key is in upper right corner of front panel of digital storage oscillograph. User can press the key so that green lamp is on to show operation status. Red lamp can be on after pressing the key to show stop status.

Figure 2-30 Operation/stop key

Automatic setup

As shown in above figure, automatic setup is to simplify operation. Digital storage oscillograph can adjust vertical deflection coefficient and horizontal time base gear automatically for stable waveform display on the screen according to waveform amplitude and frequency when user presses AUTO key. System setup is shown in following form during automatic setup:

Function	Setup
Obtainment mode	Sampling
Display format	Set to YT
Horizontal position	Automatic adjustment
Second/grid	Adjustment according to signal frequency
Trigger coupling	AC
Hold off	The minimum value
Trigger level	Set to 50%
Trigger mode	Automatic
Trigger source	Set to CH1; Set to CH2 when exerting on signal for it if there is no signal for CH1;
Trigger gradient	Ascending
Trigger type	Edge
Vertical band width	All
Volt/grid	Adjustment according to signal amplitude

RUN/STOP: To acquire waveform or stop acquisition continuously;
The key can be pressed for switchover of waveform sampling between operation and stop. User can press the key under operation status so that green lamp is on. “Auto” can be displayed in upper part of the screen. Old digital storage oscillograph can acquire waveform continuously while red lamp is on by pressing the key under stop status. Digital storage oscillograph can stop acquisition when displaying “Stop” in upper part of the screen.

Chapter 3: Application Example

The first example: Measurement of simple signal

It has to observe a unknown signal in the circuit for quick display and measurement of signal frequency and peak value.

1. Please operate according to following steps for quick signal display:

1. Please operate according to following steps for quick signal display:

① To set probe menu attenuation coefficient to 10* and set switch on the probe to 10*.

② To connect CH1 probe to measured point of circuit.

③ To press AUTO button.

Digital storage oscillograph can set automatically for the best waveform display. You can also adjust vertical or horizontal gear on above basis so that waveform display can meet related requirements.

2. Automatic measurement of signal voltage and time parameters

Digital storage oscillograph can measure most of display signals automatically. Please operate according to following steps for measurement of signal frequency and peak value.

① To press MEASURE key to display automatic measurement menu;

② To press F1 to enter into measurement menu category for selection;

③ To press F3 to select voltage category;

④ To press F5 to turn to 2/4 page then press F3 to select measurement type of peak value;

⑤ To press F2 to enter into measurement menu category for selection then press F4 to select time category;

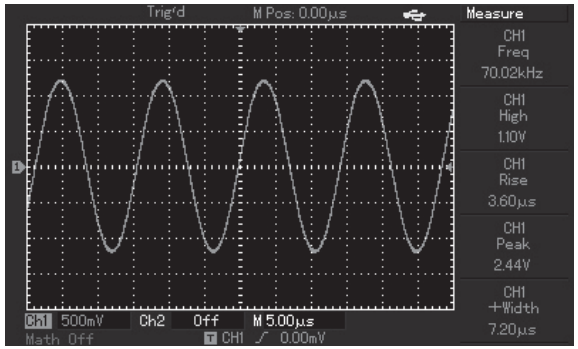


Figure 3-1 Automatic measurement

The secondexample: Delay observation of sine wave signal by circuit

The same as above example, please set attenuation coefficient of probe and digital storage oscillograph to 10*. Please connect CH1 channel of digital storage oscillograph to circuit signal input terminal and connect CH2 channel to output terminal.

Operation steps:

1. Signal display of CH1 and CH2 channels:

① To press AUTO button.

② To continue to adjust horizontal or vertical gear so that waveform display can meet your test requirements.

③ To press CH1 key to select CH1 then rotate vertical position knob to adjust vertical position of CH1 waveform.

④ To press CH2 key to select CH2 then adjust vertical position of CH2 waveform to facilitate&

comparison without waveform overlapping for the first and second channels.

2. To measure delay of sine signal caused by circuit then observe waveform variation.

① Delay of automatic measurement channel

To press MEASURE button to display automatic measurement menu;

To press F1 key to enter into measurement menu category for selection;

To press F4 key to enter into time measurement parameter list;

To press F5 key twice to enter into 3/3 page;

To press F2 key to select delay measurement;

To press F1 key to select CH1 then press F2 key to select CH2 then press F5 as enter key

You can see delay value from “CH1-CH2 delay” in F1 area.

② Observation of waveform variation (shown in following figure)

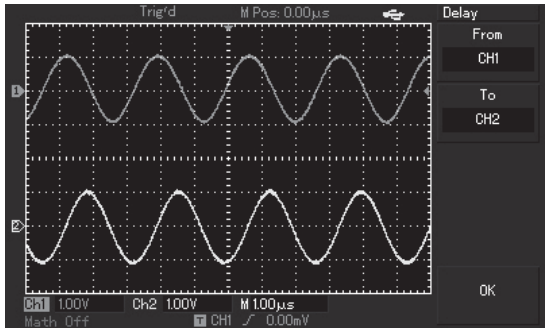


Figure 3-2: Waveform delay

The third example: Capture of single signal

Advantages and characteristics of digital storage oscillograph include convenient capture of aperiodic signals such as pulse and burring, etc. It has to know this signal to set trigger level and trigger edge to capture a signal signal. For instance: Trigger level shall be set to about 2V and set trigger edge to ascending edge trigger if pulse is a logic signal of TTL level. User can observe it by automatic or ordinary trigger mode so as to determine trigger level and trigger edge for unknown signals.

Operation steps are as follows:

1. To set attenuation coefficient of probe and CH1 channel like the previous example;

2. To set triggers;

① To press MENU button in trigger control area to display trigger setup menu.

② To set trigger type to edge, trigger source to CH1, gradient to ascend, trigger mode of single mode and trigger coupling to AC by using menu operation keys of F1 to F5 respectively under this menu.

③ To adjust horizontal time base and vertical gear to appropriate scope.

④ To rotate TRIGGER LEVEL knob to adjust appropriate trigger level.

⑤ To press RUN/STOP execution button to wait for signals which meet trigger conditions. Once sampling can be done for display on the screen if a certain signal reaches set trigger level. Occidental events can be captured easily by utilizing the function. For instance: Sudden burring with large amplitude: Please set trigger level to be higher than normal signal slightly then press RUN/STOP button for waiting. The machine will trigger automatically and record waveform before and after trigger during burring. Horizontal POSITION knob in horizontal

control area on the panel can be rotated to alter horizontal trigger position so as to gain negative delay trigger with different length to facilitate observation of waveform before burring.

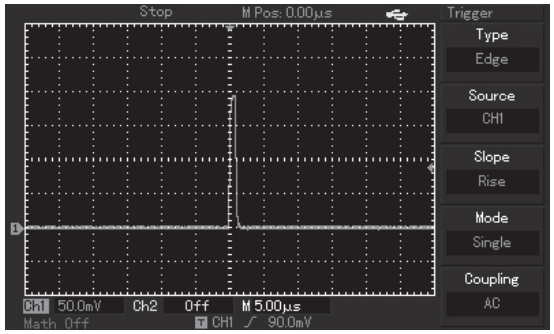


Figure 3-3 Single signal

The fourth example: To reduce random noise of the signal

You can adjust setup of digital storage oscillograph for overlapping of random noise to tested signal so as to filter or reduce noise and avoid disturbance to ontology signal during measurement. (Please refer to following figure for waveform.)

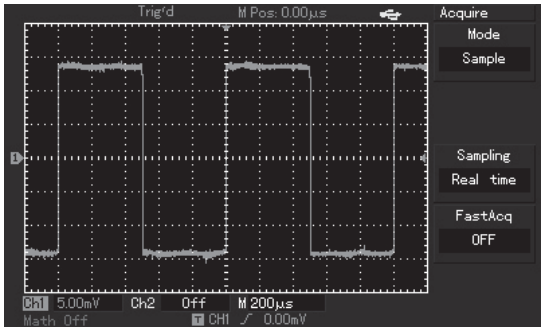


Figure 3-4 To reduce random noise of signals

Operation steps are as follows:

1. As shown in previous example, please set attenuation coefficient of probe and CH1 channel.

2. To connect signals for stable waveform display on digital storage oscillograph.

Please refer to previous example for operation. Please refer to previous chapter for adjustment of horizontal time base and vertical gear.

3. To improve trigger by setting trigger coupling.

(1) To press MENU button in trigger area to display trigger setup menu.

(2) To set trigger coupling to low-frequency inhibition or high-frequency inhibition. Low-frequency inhibition is to set a high-pass filter to filter low-frequency signal component of less than 80kHz and allow pass through of high-frequency signal component. High- frequency inhibition is to set a low-pass filter to filter high-frequency signal component of more than 80kHz and allow pass through of low-frequency signal component. It can be set to inhibit low-frequency or high-frequency noise respectively to gain stable trigger

4. To reduce display noise by setting sampling modes.

① To adopt average sampling mode to eliminate display of random noise to thinner waveform and facilitate observation & measurement if waveform is thickened by overlapping random noise to measured signal. Signal details can be observed conveniently by reduced random noise after gaining average value. Detailed operation is as follows:

To press ACQUIRE button in panel menu area to display sampling setup menu. To press F1 key as menu operation key to set obtainment mode to average status. (As shown in following figure,) please adjust average times by pressing F2 key as menu operation key with step from 2 to 256 by multiples of 2 so that waveform display can meet observation & test equirements.

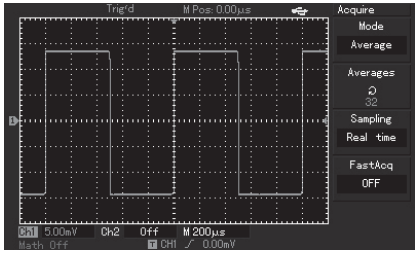


Figure 3-5 Inhibited signal noise

② To reduce display noise by reducing waveform brightness.

Note: Average sampling mode can be used to slow down updating speed for waveform display as normal phenomenon.

The fifth example: Application cursor measurement

This digital storage oscillograph can measure 28 kinds of waveform parameters automatically. All automatic measurement parameters can be measured by cursor. Waveform time and voltage can be measured quickly by using cursor.

To measure 1 staircase voltage of staircase signal

Please operate according to following steps to measure 1 staircase voltage of staircase signal:

1. To press CURSOR key to display cursor measurement menu.
2. To press F1 key as menu operation key to set cursor type to voltage.
3. To rotate multi-purpose knob controller to place the first cursor to 1 staircase of staircase signal.
4. To press SELECT or PUSHSELECT to select the cursor then rotate multi-purpose knob controller to place the secondcursor to another staircase of staircase signal.

△V, namely, pressure difference can be shown in cursor menu automatically.
Please refer to following figure for details.

Note: Please set cursor type to time if onlying adopting the secondstep as above for time measurement by cursor.

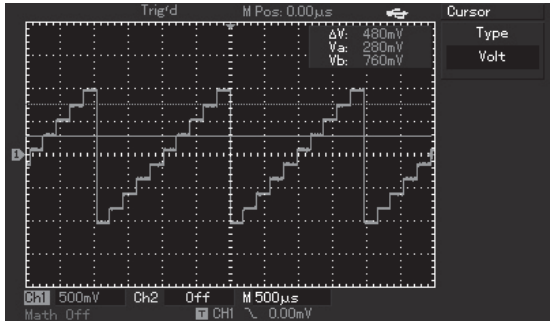


Figure 3-6 Voltage difference of signal by cursor measurement

The sixth example: Application of X-Y function

To review phase location difference of signals of 2 channels.

Example: Phase location variation caused by 1 circuit for tested signals. Please connect digital storage oscillograph to circuit to monitor input/output signal of circuits. Please operate according to following steps to review input/output terminal of circuits by way of X-Y coordinate diagram.

1. To set probe menu attenuation coefficient to 10* and set switch on the probe to 10*.
2. To connect CH1 probe to network input then connect CH2 probe to network output.
3. To press CH1 and CH2 menu keys and open 2 channels if they have not been displayed.
4. To press AUTO button.
5. To adjust vertical scale knob for approximate

6. To press DISPLAY menu key to call out display control menu.

7. To press F2 to select X-Y. Digital storage oscillograph will display input/output characteristics of circuit under Lissa Jous's figure mode.

8. To adjust vertical scale and vertical position knob to reach the best effect for waveform.

9. (As shown in following figure), please observe and calculate phase location difference by elliptic oscillograph figure method.

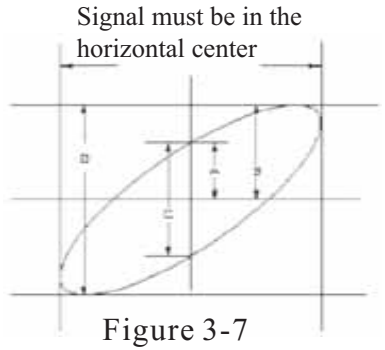


Figure 3-7

sinθ =A/B or C/D. Of which: "θ " refers to phase location difference angle between channels. Please refer to above figure for definition of A, B, C and D. Therefore, phase location difference angle is calculated as follows: =±arcsin（A/B） or =±arcsin（C/D）. Calculated phase location difference angle shall be within Quadrant I or IV (namely, (0~∏/2) or (3/2∏)~2∏) if main axle of ellipse is within Quadrant I or III. Calculated value is within (∏/2~∏) or (∏~3/2∏) if main axle of ellipse is within Quadrant II or IV. Additionally, frequency and phase location relationship between 2 signals can be calculated according to figure if frequency or phase location difference of 2 measured signals is integral multiple.

10. Form of X-Y phase location difference

Frequency ratio of signal	Phase location difference					
	0°	45°	90°	180°	270°	360°
1：1						

The seventh example: Trigger of video signal

Video trigger function can be used for all modes except UTD2000L series. (Of which: UTD2025CL has video trigger function.)

It has to adopt video trigger to gain stable video output signal display for observation of a certain video circuit.

Trigger of video field

Please operate according to following steps for trigger in video field.

1. To press[MENU]button in trigger control area to display trigger menu.
2. To press[F1] key as menu operation key to select video type.
3. To press[F2] key as menu operation key to set trigger source to CH1.
4. To press[F3] key as menu operation key to select video standard of PAL.

5. To press [F4] key as menu operation key to select synchronization of odd field or even field.
6. To adjust horizontal time base by rotating horizontal SCALE knob in horizontal control area so as to gain clear waveform display.

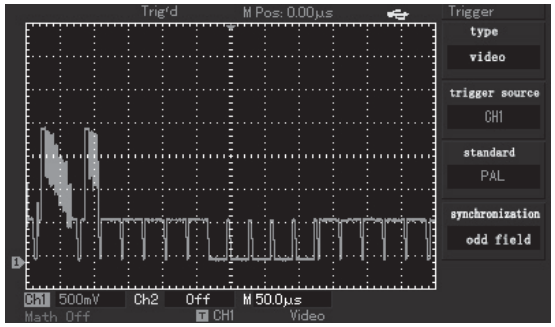


Figure 3-8 Trigger of video field

Trigger of video row

Please operate according to following steps for trigger in video row:
1. To press [MENU] button in trigger control area to display trigger area.
2. To press[F1] key as menu operation key to select video.
3. To press [F2] key as menu operation key to set trigger source to CH1.
4. To press[F3] key as menu operation key to select video standard of PAL.
5. To press[F4] key as menu operation key to select synchronization to designated row.
6. To rotate multi-purpose knob controller for trigger in any row.
7. To adjust horizontal time base by rotating horizontal SCALE knob in horizontal control area so as to gain clear waveform display.

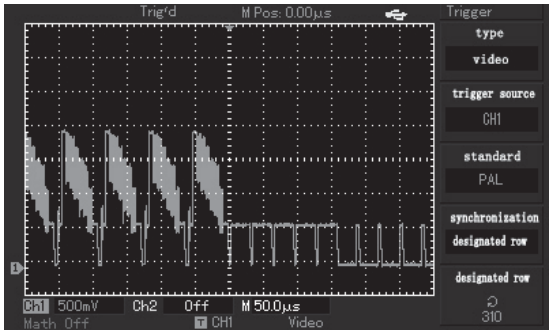


Figure 3-9 Trigger of video row

The eighth example: Pass/Fail detection

It has to check if input signal is within rule scope or not. Fail refers to out of scope and Pass refers to within the scope. Pass/Fail signal can be shown by output port.

1. To press[UTILITY] button then press[F2]Enter into Pass/Fail menu.
2. Setup of information source: Enter into Pass/Fail menu then press[F2] to select information source.
3. Template setup: To press[F4] Enter into template setup menu (Template). To press[F2] and[F3] shown in Template menu to set horizontal and vertical tolerance scope by multi-function knob, (namely, 1-200Pixel toward horizontal direction and 1-100Pixel toward vertical direction.) Please press F4 finally Return to Pass/Fail menu.
4. Setup of output conditions: To press[F3] to set output conditions shown in Pass/Fail menu.
5. To begin detection: To press[F1] to open detection status shown in Pass/Fail menu.

The ninth example: Usage of updating procedure of U-disk

Updating procedure of U-disk can be used more conveniently and flexibly. Please operate according to following steps if using this function:

1. To download procedure documents to update from Internet then save them in U-disk. (It is suggested to use U-disk suggested by us.)
2. To close oscillograph and insert U-disk then open oscillograph.
3. To turn to confirmation interface of whether to update it or not if there is only 1 procedure document in U-disk. Please press[F5] for exit or press F1 to exit procedure updating. Document selection interace will appear if there are at least 2 procedure documents in U-disk. Please press[F5] key for confirmation (or press[F1] to exit procedure updating). Please turn to confirmation interface of whether to update it or not then press[F5] for updating).
4. To wait for updating for prompt of successful updating. Please power off oscillograph then open it to fulfill updating procedure.

Note:

1. Please wait for updating for several minutes.
2. It is not allowed to power off oscillograph or plug out U-disk during updating to avoid updating failure or unforeseenable error.
3. Please power off oscillograph then open it for re-updating after updating failure.

The tenth example: Usage of storage function

Storage functions of oscillograph include setup storage, waveform storage, bitmap storage and specific screen copy function of UTD2000 series of oscillograph.

1. Setup of storage function:

It has to select display channel, trigger channel, vertical and horizontal gears of oscillograph for setup. Please press[STORAGE] key to select torage type of “setup” by pressing[F1]key. As shown in following figure, it has to select position to save by multi-function button then press F3 for saving.

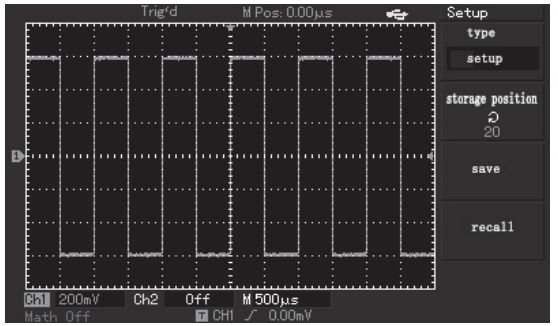


Figure 3-10 Saving setup interface

It can be tested directly during next test after saving setup to reduce re-setup process. UTD2000C series of oscillograph can save 10 kinds of setup while UTD2000E and UTD2000L series of oscillograph can save 20 kinds of setup.

2. Waveform storage function:

UTD2000 series of oscillograph can provide waveform storage function. User can press[STORAGE]key and [F1] key to select storage type of “waveform”. User can press [F2]key to select channel to save waveform then press[F5]Enter into next page. Magnetic disk in F1 menu position can designate storage position and default storage position is digital storage oscillograph (DSO) without plugging in U-disk. Stored magnetic disk position can be [DSO] or [USB] after plugging in U-disk. Default storage depth shown by F2 is ordinary and saved waveform only can be displayed by oscillograph. Storage depth can be selected to long storage to save “.data” for exportation by waveform analysis software when plugging in U-disk and selecting magnetic disk position to [USB]. It is allowed to analyze content data of every point of saved waveform. User can also press F5 Return to previous menu then select storage position by multi-function button then press [F3] for saving.

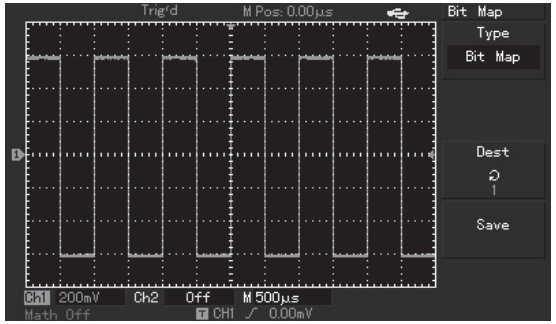


Figure 3-11 Waveform storage

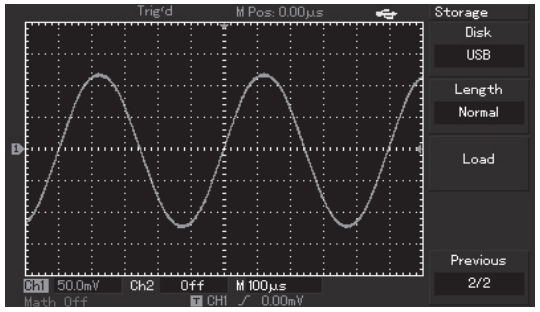


Figure 3-12 Waveform storage by U-disk

As shown in following figure, saved waveform can be recalled by short-cut key of [REF] on the panel for UTD2000C and UTD2000E series of oscillograph. User can press [F3] shown in the second page of STORAGE main menu for recall for UTD2000L series of oscillograph.

Figure 3-13 Vertical control panel of 5.7-inch screen

3. Bitmap storage function:

As shown in following figure, user can press[F1] menu key of STORAGE main menu to select storage type of "bitmap" after plugging in U-disk and successful connection of oscillograph. User can rotate multi-function knob to select saved bitmap No. Saved bitmap in U-disk with ".BMP" format can be read out

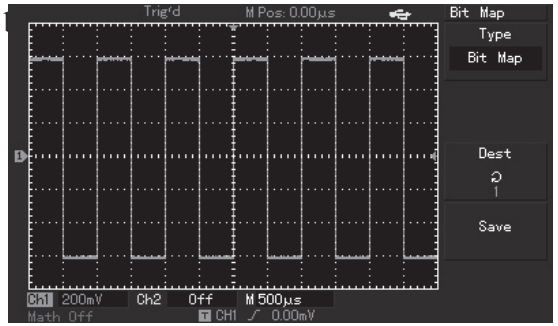


Figure 3-14 Bitmap storage

4. PrtSc copy & storage function

There is 1 PrtSc key in upper left corner of the screen for UTD2000L series of oscillograph. User can press the key for screen copy after plugging in U-disk. Displayed image can be saved in U-disk by way of ".BMP" format.

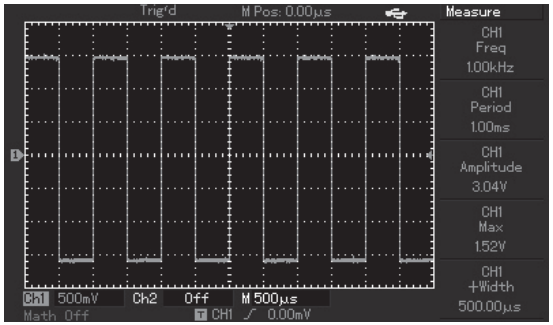


Figure 3-15 Screen copy

Chapter 4: System Prompt and Troubleshooting

Introduction to System Prompt

Regulation to the extreme: It prompts that multi-purpose knob has been regulated to the greatest extent under current status and continued adjustment is not allowed. The prompt will display when regulating vertical deflection coefficient switch, time base switch, X displacement, vertical displacement and trigger level to the terminal.

Successful connection of U-disk: The prompt will display on the screen after connecting U-disk to digital storage oscillograph and correct connection.

Plug-out of U-disk: The prompt will display on the screen when plugging out U-disk from digital storage oscillograph.Saving: The prompt will display on the screen with schedule bar below it when saving waveform

Loading: The prompt will display on the screen with schedule bar below it when calling out waveform.

Troubleshooting

1. Please operate according to following steps for black panel without display for digital storage oscillograph after pressing power switch.

① To check if power plugs are connected with normal power supply or not.

② To check if power switch is connected or not.

③ To start up the instrument again after above inspection.

④ Please contact UNI-T for service if the product still can not be used normally.

2. Please operate according to following steps if there is no signal waveform in the image after signal acquisition.

① To check if probe is connected to signal connection wire or not normally.

② To check if signal connection wire is connected to BNC (namely, channel connector) or not.

③ To check if probe is connected to articles to measure or not normally.

④ To check if signals are produced or not for articles to measure. (Channels with signal and those with any problem can be connected to find out reasons.)

⑤ To acquire signals once again.

3. Measured voltage amplitude is 10 times larger or smaller than actual value. It has to check if channel attenuation coefficient is consistent with attenuation multiple of used probe or not.

4. With instable waveform display:

① To inspect setup of trigger source shown in trigger menu to check if it is consistent with input channel of actual signal or not.

② Inspection of trigger type: General signals shall be inspected by edge trigger mode while video trigger

mode shall be used for video signals. Waveform can not be displayed stably until setting correct trigger mode.

③ Please strive to set coupling to high-frequency inhibition and low-frequency inhibition display to filter high/low-frequency noise triggered by interference.

5. To press RUN/STOP key without any display:

① To check if trigger mode of trigger menu is in normal or single gear or not. It has to check if trigger level is out of waveform scope or not.

Trigger level shall be in the middle or trigger mode shall be set to AUTO gear if yes.

② To press AUTO key for automatic setup as above.

6. Display speed will reduce after opening average time sampling mode.

① In general, speed will reduce normally if average times exceed 32.

② To reduce average times.

7. Staircase waveform display

① As normal phenomenon, horizontal time base can increase under super-low horizontal time base gear so as to increase horizontal resolution and improve display.

② Possible display type is vector and sampling points can be connected for staircase waveform display. Display type can be set to point display.

Chapter 5: Service and Support

Warranty Abstract (for UTD2000/3000 series digital storage oscillograph)

UNI-T (UNI-T Electronics (Shanghai) Co., Ltd) shall guarantee no material & process defect within 3 years after delivery date of authorized dealer for produced and sold products. UNI-T will repair and replace products with any defect within warranty period according to regulations shown in warranty sheet. Please contact the nearest UNI-T sales & repair agent for repair or claim for warranty sheet.

UNI-T company does not provide any other expressed or hidden assurance which includes but not limited to any hidden assurance for product tradability and suitability with special purpose. UNI-T company does not bear any responsibility for indirect, special or subsequent losses under any circumstance.

Contact Us

Please contact UNI-T, Inc. directly from 08:00 to 17:30 and from Monday to Friday in China Mainland if there is any inconvenience during usage. You can also contact us by E-mail. Our e-mail address is infosh@uni-trend.com.cn. Please contact local UNI-T dealer or sales center for product support out of China Mainland.

There are many service plans for most of UNI-T products to prolong warranty period and calibration period. Please contact local UNI-T dealer or sales center.

Chapter 6: Appendix

Appendix A: Technical Indicators

Unless otherwise specified, all technical dimensions are appropriate to probes by setting attenuation switch to 10× and UTD2000/3000 series digital storage oscillograph. Digital storage oscillograph must meet 2 conditions as follows to meet such dimension standards:

■ Instrument must operate under regulated operation temperature for more than 30 minutes continuously.

■ Be sure to open system function menu and execute "self-correction" procedure if variation scope of operating temperature reaches or exceeds 5℃. All dimensions shall be guaranteed except dimension with "typical" pattern.

Technical Indicators

Sampling			
	Sampling mode	Real-time	Equivalent
Sampling rate	UTD2000C/3000C	500MS/s	25GS/s
	UTD2000E/3000E	1GS/s	50GS/s
	UTD2052CL	500MS/s	25GS/s
	UTD2052CEL/ UTD2102CEL	1GS/s	50GS/s
Average value	N can be selected from 2, 4, 8, 16, 32, 64, 128 and 256 after sampling all channels for N times at the same time.		

Note: Real-time sampling rate is 250MS/s without equivalent sampling for UTD2025C, UTD3025C and UTD2025CL.

Input	
Input coupling	DC, AC, GND
Input impedance	UTD2000C/3000C: 1±2% MΩ for parallel connection to 24±3pF; UTD2000E/3000E: 1±2% MΩ for parallel connection to 24±3pF (for machine model of at most 100MHz); 1±2% MΩ for parallel connection to21±3pF (for machine model of 150MHz to 200MHz); UTD2000L: 1±2% MΩ for parallel connection to 20±3pF;
Probe attenuation coefficient	1×, 10×, 100× and 1000×
The maximum input voltage	400V (DC + AC peak value and input impedance of 1MΩ)
(Typical) delay between channels	150ps

Horizontal	
Waveform interpolation	Sin(x)/x
Record length	Sampling point of 2×512k
Storage depth	25k(UTD2000C/3000C:2.5k for UTD2025C/3025C:4k)
Scanning scope	UTD2000C/3000C: 2ns/div-50s/div (200MHz, 150MHz) UTD2000E/3000E: 5ns/div-50s/div (100MHz, 80MHz, 60MHz and 40MHz); 20ns/div-50/div (25MHz)
	UTD2000L: 2ns/div-50s/div（UTD2052CEL、UTD2102CEL） 5ns/div-50s/div（UTD2052CL） 10ns/div-50s/div(UTD2025CL)
Precision of sampling rate and delay time	±50ppm (for any interval of at least 1ms)
Measurement precision (full band width) for interval（△T）	Single mode: ±(1 sampling interval+50ppm×reading+0.6ns) ＞16 average values: ±（1 sampling interval+50ppm×reading+0．4ns）

Vertical	
Analog digital converter (A/D)	8-bit resolution with synchronous sampling for 2 channels
Scope of deflection coefficient (V/div)	UTD2000C/3000C/UTD2000E/3000E: 2mV/div~5V/div (in input BNC); UTD2000L: 1 mV/div~20V/div (in input BNC)
Displacement scope	±10div (Of which: ±5div for UTD2202E/3202E)
(Typical) optional band width limitation	20MHz
Low-frequency response (AC coupling, -3dB)	≤10Hz (in BNC)
DC gain precision (by adopting sampling or sampling mode of average value)	**UTD2000C/UTD3000C, UTD2000E/UTD3000E:** ±4% if vertical sensitivity is 2mV/div or 5mV/div; ±3% if vertical sensitivity is 10mV/div to 5V/div; **UTD2000L:** ±5% if vertical sensitivity is 1mV/div or 2mV/div; ±4% if vertical sensitivity is 5mV/div; ±3% if vertical sensitivity is 10mV/div to 20V/div;
DC measurement precision (by adopting average sampling mode)	**UTD2000C/UTD3000C, UTD2000E/UTD2000E:** If vertical displacement is 0 and N≥16: ±(4%×reading+0.1 grid+1mV) by selecting 2mV/div or 5mV/div; ±(3%×reading+0.1 grid+1mV) by selecting 10mV/div to 5V/div; If vertical displacement is not 0 and N≥16:

DC measurement precision (by adopting average sampling mode)	±【(3%×(reading+vertical displacement reading)+(1%×vertical displacement reading)】; To add 2mV when setting from 2mV/div to 200mV/div: To add set value by 50mV when setting from 200mV/div to 5V/div; **UTD2000L:** If vertical displacement is 0 and N≥16: ±(5%×reading+0.1 grid+1mV) by selecting 1mV/div or 2mV/div; ±(4%×reading+0.1 grid+1mV) by selecting 5mV/div; ±(3%×reading+0.1 grid+1mV) by selecting 10mV/div to 20V/div; If vertical displacement is not 0 and N≥16: ±【(3%×(reading+vertical displacement reading)+(1%×vertical displacement reading)】+0. 2div; To add 2mV when setting from 5mV/div to 200mV/div: To add set value by 50mV when setting from 200mV/div to 20V/div;
Measurement precision of voltage difference (△V) (by adopting sampling mode of average value)	Voltage difference between any 2 points on the waveform after calculating average value for at least 16 captured waveform under the same setup and environment conditions: ±(3%×reading+0.05div)

Note: Deflection coefficient scope of UTD2025C/3025C is 2mV/div ~ 10V/div (in input BNC).

Dand width				
Series	Model	Analog Band Width	Single Band Width	RiseTime
UTD2000C/3000C	UTD2025C、UTD3025C	25MHz	25MHz	14ns
	UTD2042C、UTD3042C	40MHz	40MHz	8.7ns
	UTD2062C、UTD3062C	60MHz	60MHz	5.8ns
	UTD2082C、UTD3082C	80MHz	80MHz	4.3ns
	UTD2102C、UTD3102C	100MHz	100MHz	3.5ns
	UTD2152C、UTD3152C	150MHz	100MHz	2.3ns
	UTD2202C、UTD3202C	200MHz	100MHz	1.8ns
UTD2000E/3000E	UTD2042CE、UTD3042CE	40MHz	40MHz	8.7ns
	UTD2062CE、UTD3062CE	60MHz	60MHz	5.8ns
	UTD2082CE、UTD3082CE	80MHz	80MHz	4.3ns
	UTD2102CE、UTD3102CE	100MHz	100MHz	3.5ns
	UTD2152CE、UTD3152CE	150MHz	100MHz	2.3ns
	UTD2202CE、UTD3202CE	200MHz	100MHz	1.8ns
UTD2000L	UTD2025CL	25MHz	25MHz	14ns
	UTD2052CL	50MHz	50MHz	7ns
	UTD2052CEL	50MHz	50MHz	7ns
	UTD2102CEL	100MHz	100MHz	3.5ns

Trigger		
Trigger sensitivity	≤1div	
Trigger level scope	Internal	±5div away from screen center
	EXT	±3V
	EXT/5*	±15V
(Typical) precsion of trigger level for signal of which RiseTime or DescendTime is not less than 20ns	Internal	±(0.3div×V/div) (within scope of ±4div from screen center)
	EXT	±(6% of set value+40mV)
	EXT/5*	±(6% of set value+200mV)
Pre-trigger ability	Normal mode/scanning mode, pre-trigger/delay trigger with adjustable pre-trigger depth	
Inhibition scope	UTD2000C/3000C/UTD2000E/3000E: 100ns-1.5s UTD2000L: 80ns-1.5s	
(Typical) level set to 50%	Input signal frequency ≥50Hz	
Edge trigger		
Edge type	Rise, fall, rise and fall (UTD2000C has no “rise and fall” function);	
Pulse width trigger		
Trigger mode	To be more than, less than or equivalent to positive/negative pulse width;	
Pulse trigger	20ns-10s (UTD2025/3025:40ns-25s)	

Video trigger*		
Trigger sensitivity (typical video trigger)	Internal	Peak value of 2div
	EXT	400mV
	EXT/5*	2V
Signal system and row/ field frequency (video trigger type)	To support standard NTSC and PAL; Scope of row quantity is 1-525 (NTSC) and 1-625 (PAL)	
ALT TRIG		
CH1 trigger	Edge, pulse and video	
CH2 trigger	Edge, pulse and video	

Note*: UTD2000L series has no EXT/5 function. Others also have no video trigger function except UTD2025CL.

Measurement		
Cursor	Manual mode	Voltage difference (△V) between cursors; Time difference (△T) between cursors; Reciprocal of △T (1/△T)
	Tracing mode	Voltage and time of waveform point
	Auto matic measurement mode	It is allowed to display cursor during automatic measurement.
Automatic measurement	Peak value, amplitude, the maximum value, the minimum value, top value, bottom value, middle value, average value, root-mean-square, overshoot, preshoot, frequency, cycle, RiseTime, falling time, positive pulse width, negative pulse width, positive duty cycle, negative duty cycle and delay	
Mathematical operation	+, -,×, ÷	
Stored waveform	UTD2000C/3000C: 10 groups of waveform and 10 kinds of setup UTD2000E/3000E/UTD2000L: 20 groups of waveform and 20 kinds of setup	
FFT	Window	Hanning, Hamming, Blackman, Rectangle
	Sampling point	1024 points
Lissajous's figure	Phase location difference	±3 degrees

Trigger frequency meter*	
Reading resolution	6-bit
Trigger sensitivity	≤30mVrms
(Typical) precistion	±51ppm (+1 word)

General technical dimension

Display		
	UTD2000C/3000C/UTD2000E/3000E	UTD2000L
Display type	Diagonal with diagonal of 145mm (5.7 inches)	Diagonal with diagonal of 178mm (7 inches)
Display resolution	320 (horizontal)×RGB×240 (vertical pixels)	800 (horizontal) ×RGB×480 (vertical pixels)
Display color	Colorful	
Waveform brightness*	Adjustable (color)	
(Typical) backlight strength	300nit	
Category of display language	Multilingual selection	

Note*: UTD2000C/3000C series have no function of trigger frequency meter (except UTD2025C/3025C). Waveform brightness can not be adjusted.

Probe compensator output	
(Typical) output voltage	About 3V if peak value is not less than 1MΩ
(Typical) frequency	1kHz

Interface function	
Standard configuration	UTD2000C/3000C/UTD2000E/3000E: 1 USB (D); 1 USB (H); UTD2000L: 1 USB OTG
Optional fittings	UTD2000C series, UTD2000E/3000E series: LAN; UTD3000C series: GPIB and LAN (Only LAN can be selecte for UTD3025C)

Power	
Power voltage	100-240VACRMS, 45-440Hz, CAT II
Power consumption	To be less than 30VA
Fuse	F1.6AL 250V; Fuses of UTD2000/UTD2000E series are on power board in the machine; Fuses of UTD3000/UTD3000E series are in power socket; Fuses of UTD2000L series are on power board in the machine.

Environment	
Temperature scope	Operation: 0℃~+40℃
	Non-operation: -20℃~+60℃
Cooling method	Forced cooling by fan
Humidity scope	＜35℃：≤90%RH ， ＋35℃～＋40℃：≤60%RH
Altitude	Operation elevation of less than 3,000m
	Non-operation elevation of less than 15,000m

Machine dimension				
		UTD2000C UTD2000E	UTD3000C UTD3000E	UTD2000L
Dimension	Width	320mm	320mm	306mm
	Height	150mm	150mm	147mm
	Depth	130mm	292mm	122mm
Weight	Not containing package	2.5kg	4.9kg	2.2kg
	Containing package	4.0kg	6.8kg	3.3kg

IP protection
ip2 X

Adjustment interval
Suggested calibration period is 1 year.

Appendix B: Fittings of UTD2000/3000 series digital storage oscillograph

Standard fittings:

- 2 inactive probes of 1.2m and 1:1 (10:1); Please refer to manual of probe fittings of details to meet EN61010-031:2008 standard.
- 150V CAT II grade if switch is in 1×position;
- 300V CAT II grade if switch is in 10× position;
- 1 "power "wire to meet national standards;
- 1 "Operation Manual";
- 1 "Warranty Certificate";
- Communication control software of UTD2000/3000 oscillograph;
- USB connecting wires:

UTD2000C/3000C/2000E/3000E: UT-D06

UTD2000L: UT-D05

Optional fittings:

- UTD2000 series: LAN module: UT-M01
- UTD3000 series: LAN module: UT-M05
- UTD3000Cseries: GPIB module: UT-M02

Please order all fittings (standard pieces and optional fittings) from local UNI-T dealer.

Appendix C: Maintenance and cleaning

General maintenance

It is not allowed to store or place instruments in locations with direct sunshine for LCD for a long time. Note: It is not allowed to touch instrument or probe by pressurized spray, liquid or solvent to avoid damage.

Cleaning:

Instrument and probe can be inspected constantly according to operation.

Please clean outer surface of instruments according to following steps:

1. Please remove floating dust out of instrument and probe by soft cloth. Please do not scratch transparent LCD protection screen during cleaning.
2. Please power off when cleaning the instrument by wet soft cloth without dripping. It can be cleaned by soft detergent or clean water. It is not allowed to use any corrosive chemical detergent to avoid damage to instrument or probe.

Warning: Please confirm that instrument has been dried thoroughly before power re-supply to avoid electric short-circuit even personal injury due to moisture.

The information is subject to changes without prior notice if manual content varies.

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